

# THE POLAR TIMES

VOL. 2, NO. 1 • SPRING 1993



## Secretary's Letter

Malcolm Browne and Dick Chappell contacted me nine months ago with the request that the Hero Foundation begin publishing *The Polar Times* for the American Polar Society. They assured me that *The Polar Times* and, hence, the American Polar Society were dead if we did not take over. It had not been published since 1986, and editor August Howard had passed away two and a half years later (see article on page 3). Expecting to find a way to rationalize turning down the offer, I said I would give it some consideration.

I was not at all sanguine about the idea, considering the workload involving the Hero Foundation and our primary task of developing the Richard E. Byrd National Antarctic Center. However, we were faced with the task of publishing our own newsletter. Perhaps we could include news of development of the National Antarctic Center as well?

Della Weston, our advertising manager, was exuberant. "This project has the potential to become truly national

in scope," she said. She can see the future much clearer than most. Della assumed the job of editor.

Next, Arthur Dumont, who edits the *Ice Cap News*, offered to handle the printing and mailing. Things were beginning to shape up. Others volunteered to help write and edit.

We decided to shoot for April 1993 to get out the first issue. As you can see, we have tried to capture the essence of August Howard, but there are some changes. We are also increasing the annual contribution to \$10 (\$12, foreign) to cover costs (see application form below).

We need your input, however. We want this to be your magazine/newsletter. Please write us when you mail in your contributions.

The process of pulling this together has certainly been rewarding. The American Polar Society is alive and well, thanks to a very dedicated staff of people here at the National Antarctic Center who, like August Howard, have never been to "the ice"—north or south. We OAEs owe them a vote of thanks.

Sincerely,

*Brian Shoemaker*

## Editor's Note

Our future success is largely dependent upon you, especially those of you in the field in the polar regions. Send us your articles and news clippings from your publications. Original manuscripts are welcome (300 words or less, with a maximum of two photos). We reserve the right to edit.

We also need you to pass this issue around and to urge your friends to join the Polar Society. It is a national calling.

Sincerely,

*Della Weston*

## American Polar Society

Box 692 • Reedsport, OR 97467 • PHONE (503) 759-3589 • FAX (503) 759-3403

Membership in the American Polar Society is open to all who are interested in the Polar regions. Dues are \$10 per year (\$12 foreign, \$100 corporate) and entitles the member to an annual subscription to *The Polar Times*.

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## The Polar Times

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by the  
AMERICAN POLAR SOCIETY

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P.O. Box 692 • Reedsport, OR 97467

DELLA WESTON, Editor  
INGRID SHOEMAKER, Asst. Editor

The American Polar Society was founded Nov. 29, 1934, to band together all persons interested in polar exploration. Membership dues are \$10 a year (\$12, foreign), and entitle members to receive *The Polar Times* twice a year.

The American Polar Society is classified as a tax exempt organization under Sec 501(A) IRS Code.

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# The Polar Times

American Polar Society • Spring 1993

## Polar Times Collates Reports and Pictures of Explorations

by a Staff Correspondent of  
The Christian Science Monitor

NEW YORK, FRIDAY, MARCH 14, 1947—This center of the publishing industry is the home of one of the most unusual publications in the world, *The Polar Times*.

This is a semi-annual published by the American Polar Society, which has its headquarters at the American Museum of Natural

History. It deals entirely with information about the ends of the earth.

*The Polar Times* is not published for the few transient residents of the Polar zones—explorers and Eskimos—but for the more than 500 members of the Polar Society in 41 states and 16 foreign lands. The roster of the society members reads like a "Who's Who in Polar Exploration." Half of them have visited the Polar regions.

August Howard, founder and secretary of the society, is editor of *The Polar Times*, which assembles its material from newspapers, magazines, and research reports.

The Navy's 4,000-man, 13-ship Antarctic expedition is now homeward bound, but a great job lies ahead for Editor Howard, who

is now reviewing many thousands of words of press dispatches from the Antarctic, selecting photographs and maps to tell the story of this latest attempt to erase the word "unknown" from Antarctic areas.

Since it was organized in 1934 "to band together persons interested in the history and exploration of the Arctic and Antarctic regions," the society has honored four distinguished explorers as honorary members. The first was the late Gen. David L. Brainard, a member of Gen. A. W. Greely's Arctic expedition of 1881-'84. Others were Rear Admiral Richard E. Byrd, Dr. Vilhjalmur Stefansson, and Lieut. Commander Lincoln Ellsworth.

Charles H. Stoll, leader of an expedition, in 1928, which discovered mummies of Stone Age men in the Aleutian Islands, is president of the society. Officers and board members include Laurence M. Gould and Thomas C. Poulter, who helped direct Byrd Antarctic Expeditions of over a decade ago, and Louise A. Boyd, noted woman Arctic explorer. □

## Massey Appoints Cornelius Sullivan Director Of OPP

FEBRUARY 25, 1993—Walter Massey, director of the National Science Foundation (NSF) announced today that he has appointed Cornelius W. Sullivan, currently director of the Hancock Institute for Marine Studies and professor of biological sciences at the University of Southern California, as the new director of the Office of Polar Programs (OPP).

Sullivan's appointment begins May 16, 1993.

"Cornelius Sullivan is one of the world's leading polar scientists," Massey said. "He has led many interagency and international expeditions to Antarctica and has carried out research in the Arctic. As a former member of the National Academy of Sciences' Polar Research Board, he is also a leading voice in polar research policy circles." □

## August Howard, 78, Organizer of a Society for Polar Explorers

by Malcolm W. Browne

NEW YORK TIMES, DECEMBER 7, 1988—August Howard, founder of the American Polar Society and the editor of a newsletter for polar explorers and researchers, died of heart disease Sunday. He was 78 years old and lived in Rego Park, Queens.

Mr. Howard was a public affairs officer of the National Council of Boy Scouts of America from 1928 to 1970, but he was better known for his voluntary efforts to further exploration and understanding of the Arctic and Antarctica. The year after Mr. Howard joined the Boy Scouts staff, Rear Adm. Richard E. Byrd selected a scout, Paul Siple, to accompany an Antarctic expedition. Mr. Howard helped publicize the selection, and his passionate interest in polar activities dated from that time.

In 1934, Mr. Howard founded the American Polar Society as a forum for people involved or interested in polar exploration and research. In 1935, largely at his own expense, he began publishing *The Polar Times*, a semi-annual compendium of articles about the poles, culled mostly from newspapers, magazines, and scientific journals. The newsletter was distributed free to members of the society, who paid annual dues of \$2.

Most leading polar explorers, scientists, and expedition members of the 30s and 40s joined the society. Mr. Howard was its sec-



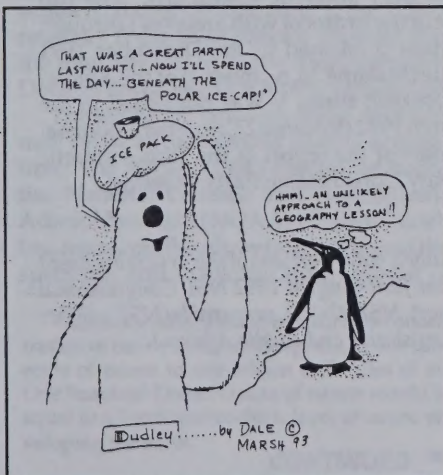
AUGUST HOWARD

retary and administrative officer until his death.

Although Mr. Howard never visited either polar region, his work on behalf of professionals won the praise of such explorers as Admiral Byrd, Lincoln Ellsworth, and Mr. Siple.

Two landmarks in Antarctica, Cape Howard on the Wedell Sea and *The Polar Times* Glacier, were named in his honor by the expeditions that placed them on the map.

Surviving are his wife, Rose, and two children, Alan and Doris. □



## U.S. Senate endorses environmental protocol: implementation bills introduced

On 7 October, just before the close of the second session of the 102nd Congress, the Senate gave its "advice and consent" to ratification of the Protocol on Environmental Protection to the Antarctic Treaty. However, before the President can sign the instrument of ratification, both the House of Representatives and the Senate must pass the necessary implementation legislation. After the implementation legislation is passed and the President has signed the instrument of ratification, the other Antarctic Treaty Consultative Parties will be notified that the United States formally recognizes the protocol.

### U.S. implementing legislation

During the second session of the 102nd Congress, four bills proposing implementation plans were introduced in the House of Representatives and the Senate. The debate by the Congressional committees centered on which federal agency should have primary responsibility for implementing the protocol and the requirements of the legislation. The Antarctic Conservation Act of 1978 (Public Law 95-541) currently provides the Director of the National Science Foundation (NSF) with much of this responsibility, as does Presidential Memorandum 5546. This presidential memorandum, signed by President Reagan in 1982, instructs NSF to "budget for and manage the entire U.S. national program in Antarctica, including logistic support activities so that the program may be managed as a single package."

**H.R. 5459/S. 3189**—the Antarctic Environmental Protection Protocol Act of 1992—was introduced by Congressman Walter B. Jones (D-NC), Chairman of the Merchant Marine and Fisheries Committee, and Senator John Cairo (D-MA).

These bills give the National Oceanic and Atmospheric Administration (NOAA), with the assistance of the U.S. Coast Guard and the Administrator of the Environmental Protection Agency, responsibility for enforcing the antarctic environmental protocol. Although NSF would continue to be responsible for carrying out the U.S. research program in Antarctica, NSF would

be required under H.R. 5459 to obtain a 5-year permit to operate U.S. stations and other science-support facilities in Antarctica. H.R. 5459 also repeals the Antarctic Conservation Act and the Antarctic Protection Act of 1990.

Besides the provisions listed above, H.R. 5459 requires land- and ship-based contingency plans for oil spills; mandates peer review of scientific takings of native species; and phases out the operation of incinerators in Antarctica after 31 December 1994. It also requires that U.S. companies operating tourist expeditions obtain permits every 3 years.

In June, a joint hearing on H.R. 5459 was held by the House Merchant Marine and Fisheries Subcommittee on Oceanography, Great Lakes, and the Outer Continental Shelf; the Subcommittee on Fisheries and Wildlife Conservation and the Environment; and the Subcommittee on Coast Guard and Navigation. During the hearing, the representatives heard testimony from the Department of State, NOAA, NSF, and various environmental, tourist, scientific, and academic organizations.

On 6 August 1992, H.R. 5459 was marked out of the Merchant Marine and Fisheries Committee. The Administration opposed this version of the bill.

**H.R. 5801/S. 3231**—the Antarctic Environmental Protection Act—was introduced by Congressman Rick Boucher (D-VA), Chairman of the House Subcommittee on Science, and Senator Claiborn Pell (D-RI). H.R. 5801 and S. 3231 are the Administration's bills to implement the Protocol on Environmental Protection to the Antarctic Treaty. They amend the Antarctic Conservation Act of 1978 (Public Law 95-541) to bring this act in line with the protocol and its annexes. Specifically, Title II of H.R. 5801 repeals the Antarctic Protection Act of 1990 (Public Law 101-594) and replaces the temporary provisions of this act with a new prohibition on mineral resource activities in Antarctica, making U.S. law consistent with the protocol. (See Volume 26, number 1, pages 10-11, of the *Antarctic Journal* for a description of Antarctic Protection Act of 1990.)

H.R. 5801 was referred to the House Committee on Science, Space, and Technology; the Committee on Merchant Marine and Fisheries; and the Committee on Interior and Insular Affairs.

Before they adjourned in October, Congress did not hold any more hearings or

take any further action on these protocol implementation bills.

### The environmental protocol and ratification

The Protocol on Environmental Protection to the Antarctic Treaty, which was signed on 4 October 1991 by 23 of the 26 consultative parties at a special treaty meeting in Madrid, Spain, extends and improves the effectiveness of the Antarctic Treaty system to preserve the antarctic environment. By designating Antarctica as a natural reserve, devoted to peace and science and establishing a 50-year ban on mineral resource activities, it is designed to protect the continent's environment, as well as its dependent and associated ecosystems.

Besides advancing standards for environmental assessment and management, the 27-article agreement contains a system of annexes that provide for continuing review and evaluation of environmental protection measures and incorporates mandatory rules for environmental protection. The consultative parties have adopted five annexes—four in October 1991 when the protocol was signed and a fifth in March 1992 during the 16th Antarctic Treaty Consultative Meeting. These annexes focus on environmental impact assessment procedures, conservation of fauna and flora, waste disposal and management, prevention of marine pollution, and specially protected areas.

The protocol enters into force 30 days after all 26 consultative parties have ratified it. Although this process could take from 2 to 10 years, the consultative parties have agreed to apply its terms when planning their antarctic operations. The full text of the protocol with annexes I through IV was published in the December 1991 issue (Volume 26, number 4) of the *Antarctic Journal*; annex V was published in the March 1992 (Volume 27, number 1) journal as part of the report of the 16th Antarctic Treaty Consultative Party Meeting.

*(Editor's note: Portions of this article are based on the June-August 1992 NSF Congressional Report, NSF 92-152, prepared by NSF's Office of Legislative and Public Affairs.)*

# 1992 ozone depletion: A response to the Pinatubo eruption?

The debate continues over whether or not the 1991 eruption of the Philippine volcano Mount Pinatubo affected the annual springtime "ozone hole" that develops above Antarctica. Before the ozone hole began to form in 1992, researchers predicted that the presence of volcanic debris—principally sulfuric acid droplets—in the atmosphere would cause chemical reactions that could increase the amount of ozone depleted from the antarctic stratosphere and break the records set in the years of 1987, 1990, and 1991.

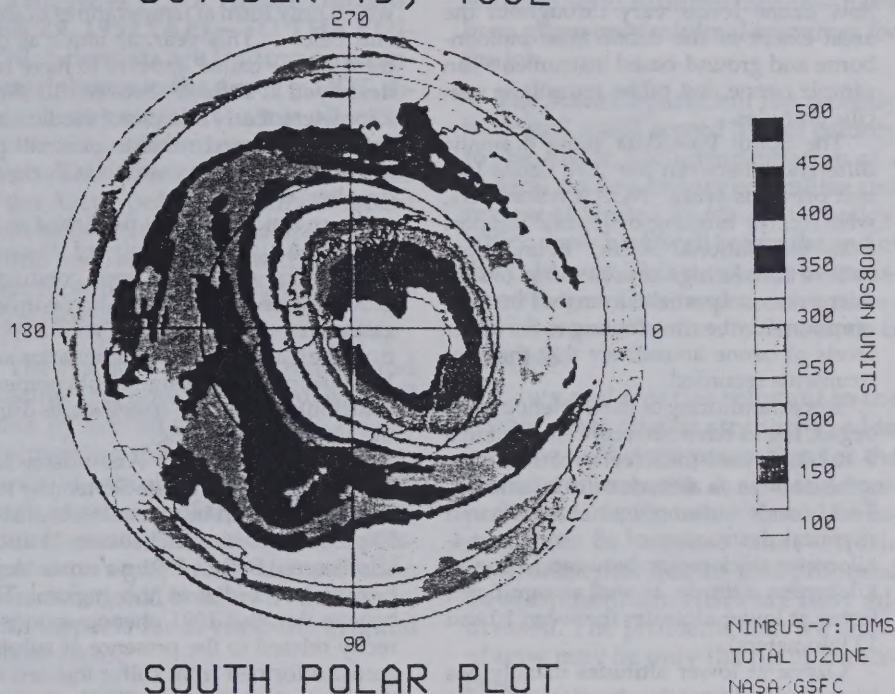
By late September 1992 the ozone hole covered an area that was an unprecedented 23 million square kilometers in size—an area about 3 million square kilometers larger than previous years. The available data also indicated that the depth of the depleted area was growing at a faster pace than had been recorded in the past.

Not long after these data were recorded, however, weather patterns over the Pacific Ocean caused a dramatic shift in the position of the polar vortex, the belt of winds that seal off the antarctic atmosphere, prevent mixing with warm ozone-rich air, and create the environment in which polar stratospheric clouds form. Unexpectedly, a large, warm, ozone-rich air mass moved into the antarctic atmosphere and disrupted the track of the vortex. Some researchers believe that the warmer Pacific air mass weakened the barrier created by the polar vortex and helped slow the depletion rate.

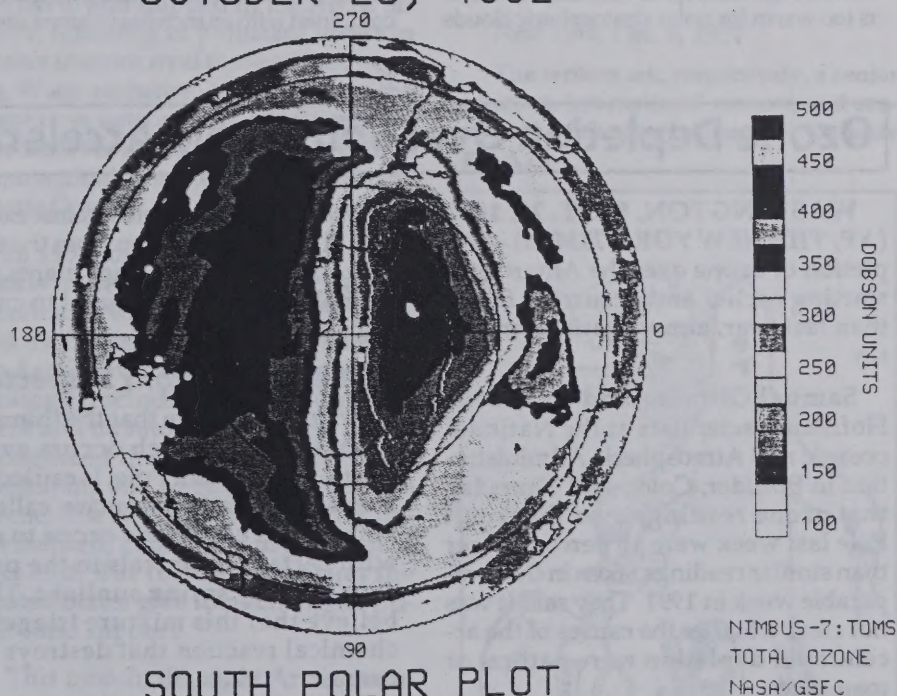
The debate among scientists focuses on how much ozone was depleted during the height of the depletion process. In early October, at the peak of the depletion cycle, satellite data obtained from the National Aeronautics and Space Administration's (NASA) total ozone mapping spectrometer (TOMS) indicated that this year's depletion never dropped below about 126 Dobson units\*. Meanwhile, researchers using balloon-borne and ground-based instruments at the geographic South Pole acquired data that contradicted the TOMS results. Their observations showed that the total amount of ozone dropped to 105 Dobson units, below the 1991 record low.

The disparity between these data sets may relate to the method of data acquisition. The NASA TOMS system, on board the National Oceanic and Atmospheric Administration's (NOAA) *Nimbus-7* satellite, measures the ultraviolet portion of the spectrum and maps the total amount of

OCTOBER 15, 1992



OCTOBER 20, 1992



NASA illustrations.

On 15 October 1992, the total ozone mapping spectrometer (TOMS) aboard the *Nimbus-7* satellite recorded a large area depleted of ozone (lightest area in illustration) above Antarctica. The TOMS plot also shows the full area of the hole—which at its maximum extent covers 23 million square kilometers. The second TOMS plot, taken five days later on 20 October 1992, shows how much the hole has moved and how ozone levels have increased (note smaller light area). Scientists believe that a warm Pacific air mass forced the depleted area to shift rapidly and weaken the polar vortex. As a result, the depletion may have been slowed.

\*A Dobson unit, used to measure the concentration of ozone in the stratosphere, is one molecule of ozone to one billion molecules of air. One hundred Dobson units of ozone would be equal to a 1-millimeter-thick layer of ozone enveloping the earth.

CONTINUED ➡

ozone within a 3,000-kilometer sector. While TOMS data provide a broad view of how ozone levels vary throughout the areal extent of the ozone hole, balloon-borne and ground-based instruments can sample ozone and other aerosols at specific altitudes.

The South Pole data show dramatic differences between the 1992 ozone loss and previous years. NOAA researchers, who receive funding or logistic support from the National Science Foundation, believe that the high concentration of sub-micron aerosol particles from the Pinatubo eruption may be contributing to the lower levels of ozone abundance that their instruments recorded.

Since monitoring of the depletion cycle began, losses have been concentrated in a 1- to 2-kilometer-thick region of the stratosphere above an altitude of 16 kilometers. This year's balloon launches showed chemical destruction of all ozone in a 4-kilometer-thick region between 14 and 18 kilometers altitude, as well as significant losses at lower altitudes (between 10 and 13 kilometers).

Ozone at lower altitudes usually has been shielded from the chemical reactions that destroy ozone in the upper altitudes because the atmosphere at these altitudes is too warm for polar stratospheric clouds

to form. The reactions that release chlorine from chlorofluorocarbons take place on the surfaces of ice crystals in those clouds, which only form at temperatures of -80 °C and below. This year, as much as one-third of the ozone appears to have been destroyed at altitudes between 10 and 13 kilometers. Early analysis of the data indicate an increased number of small particles, believed to be volcanic sulfuric-acid droplets, were present.

In an article recently published in *Nature*, NOAA and University of Wyoming researchers, who have been conducting ground-based and balloon-borne investigations of the ozone hole with support from the National Science Foundation since 1986, propose that a similar phenomenon contributed to record ozone losses during the 1991 austral spring.

At McMurdo and Amundsen-Scott South Pole Station in late September 1991, they began observing ozone losses of about 50 percent at altitudes between 11 and 13 kilometers. Before 1991 no ozone depletion was recorded in this region. They believe that this 1991 phenomenon is directly related to the presence of sulphate aerosols formed from sulfur injected into the lower atmosphere by the August 1991 eruption of a Chilean volcano Mount Hudson. The lower-altitude depletion, combined with an increase in ozone deple-

tion above 25 kilometers, probably accounts for about 10 to 15 percent of the 1991 ozone low.

According to their theory, during the 1992 austral winter volcanic aerosols from the Mount Pinatubo eruption would have been trapped when the polar vortex formed, setting up the necessary conditions for ozone destruction at lower altitudes. South Pole balloon observations this austral spring appear to support this theory, despite the contradiction with the NASA satellite data. However, until all observations are recorded and analyzed, the extent to which the Philippine volcano has affected the antarctic atmosphere remains unresolved.

#### Additional sources of information

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## Ozone Depletion Over South Pole Accelerates

WASHINGTON, SEPT. 26, 1992 (AP, *THE NEW YORK TIMES*)—Depletion of ozone over the Antarctic is starting earlier and occurring faster than last year, atmospheric scientists say.

Samuel Oltmans and Dr. David Hofmann, scientists at the National oceanic and Atmospheric Administration in Boulder, Colo., said Thursday that ozone readings over the South Pole last week were 15 percent lower than similar readings taken in the comparable week in 1991. They said it was not clear whether the causes of the accelerated depletion were natural or man-made.

Ozone readings, which have been taken since 1986, dipped to previous lows in 1987 and in 1991. This year, Dr. Hofmann said, "We're seeing lower values in September than ever before."

"It started sooner, and it's going down a lot faster than in 1991."

Ozone acts as a shield against excessive ultraviolet radiation from the sun, which is known to damage plants and animals, and is also thought to cause skin cancer in humans.

### Volcanic Eruptions Suspected

Scientists believe that the thinning of this shield, which occurs every spring at the South Pole, is caused by a seasonal rotating air mass, called a vortex, that causes the ozone to mix with certain chemicals in the presence of early spring sunlight. They believe that this mixture triggers a chemical reaction that destroys the ozone.

Mr. Oltmans and Dr. Hofmann said that measurements with high-altitude balloons had shown ozone values on Sept. 14 of 170 Dobson units, as against a reading on Sept. 12, 1991, of 200 Dobson units. A dobson unit is a measure of the total ozone in a column of atmosphere from the ground up.

The researchers said in a statement that this month's readings may be a result of both man-made chemicals and the sulphur dioxides that were ejected into the atmosphere by the volcanic eruptions of Mount Pinatubo in the Philippines and of Mount Hudson in Chile.

Mr. Oltmans said the ozone values are lowest from 7 to 13 miles above Antarctica, which is also the atmospheric region where the volcanic chemicals are present.

Man-made chemicals, mainly the chlorofluorocarbons used in refrigerators, air conditioners, and several industrial processes are also thought to play a large role in the ozone depletion. □

## Antarctic Adventurers Grind to Halt

by The Baltimore Sun

LONDON—Two polar explorers were lifted off the Ross Ice Shelf in the Pacific Antarctic on Friday "more dead than alive," and Britain found itself with two new heroes to celebrate.

Ranulph Fiennes, 48, and his 37-year-old partner, Dr. Michael Stroud, covered 1,350 miles in their trek across the southernmost continent, completing what one person involved in the expedition described as "the longest unassisted journey at either pole."

Starting at Gould Bay near the Atlantic NOV. 9, they reached the South Pole on Jan. 16, and last weekend became the first people to walk all the way across the land mass of Antarctica carrying their own supplies, without the assistance of dogs.

They had hoped to make it to the Scott Polar Base, 1,700 miles from their starting point, but they ground to a halt on the sea ice 350 miles short.

The two men were lifted off the ice by a de Havilland Twin Otter aircraft and taken to their Patriot Hill base camp, where they were said to be exhausted, but in good spirits.

For more than three months, the men endured winds of up to 100 mph and temperatures as low as minus 60. They pulled their 400-pound supply sleds over pressure ridges and mountains as high as 10,000 feet, fell into crevasses, and each lost one ski pole, making forward movement even more arduous.

The luster of their achievement was dimmed somewhat Jan. 7, when Erling Kagge, a 29-year-old Norwegian, skied into the U.S. Amundsen-Scott station at the South Pole, having started 814 miles away at the Weddell Sea. He became the first person to reach the pole unaided.

However, Fiennes and Stroud, over 100 miles short of the pole at that time, maintained they were in it for the long haul, to become the first to cross the continent unassisted.

David Harrison, a spokesman for the British Multiple Sclerosis Society, which helped coordinate the trip to raise money, said it could generate as much as \$3 million for the fund. □

## We Have to Protect No-Longer-Pristine Arctic

THE NEW YORK TIMES, DECEMBER 29, 1992, (AP)—TO THE EDITOR: Scientists are finding environmental threats to the Arctic in DDT, dioxin, heavy metals, chronic oil leaks, severe air pollution, and acid rain deposits. This goes further than the risks to the Arctic people and environment from radioactive contamination, PCBs, ozone loss, and global warming that were reported in three *Science Times* articles Nov. 24.

The Arctic is no longer remote and pristine. It is now threatened, from all sides, by human activities. We are just discovering the extent of pollution, much of which was hidden by the cloak of secrecy of the cold war. The Environmental Defense Fund's assessment shows graphically that pollution crosses national borders in the Arctic, with impacts far beyond the original source areas.

Air pollution, mostly from industrial sites in Eurasia, is transported to the north and trapped in the Arctic air mass, resulting in pollutant levels in winter that can rival those of Los Angeles. Water pollution, transported in the giant river networks that drain most of northern Asia, transport contaminants from agriculture and industry into the Arctic Ocean.

In 1991, the eight Arctic rim countries—United States, Canada, Iceland, Denmark, Norway, Sweden, Finland, and the former Soviet Union—adopted an Arctic environmental protection strategy (including an Arctic assessment and monitoring program) which recognized the need to cooperate in identifying and combating risks to the Arctic. The strategy, if effectively implemented, could be a useful tool to this end. But this requires that the United States give it much higher priority and support.

This month, the eight Arctic countries, meeting under the umbrella of the strategy, agreed to adopt an Arctic-wide monitoring plan to provide new information on the extent of risks, including radioactivity. The technical agencies in the United States that would take the leading roles in this plan—the Environmental Protection Agency and the National Oceanic and

Atmospheric Administration—have been given only minimal resources for the job.

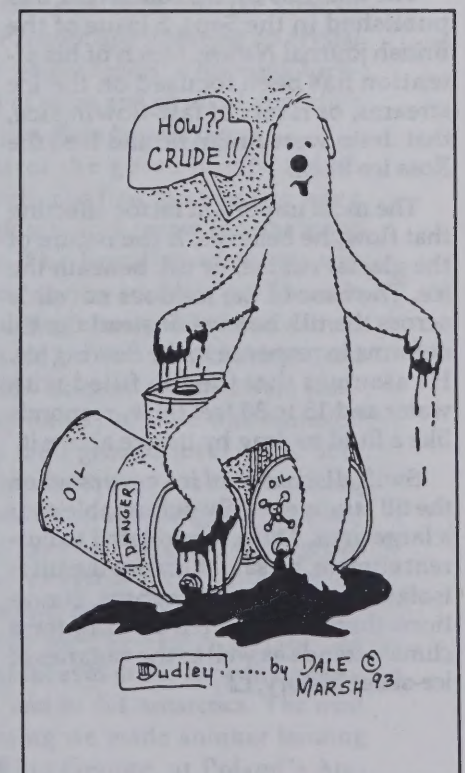
The State Department has recently indicated it will accord higher priority to the Arctic, including creation of a Federal Arctic advisory committee and review of United States Arctic policy, which dates back well before the end of the cold war. This must still be translated into reality, and much greater government attention to the Arctic is required.

Laws and treaties relevant to the Arctic must also be strengthened to provide sufficient protection for the Arctic environment. A new and comprehensive Arctic treaty should be negotiated to ensure that Arctic environmental threats and proposed development activities are fully addressed. The problems that we know of now may be only the tip of the iceberg.

Stephanie L. Pfirman, Scott A. Hajost, Kathleen Crane

New York, Dec. 9, 1992

The writers are, respectively, a senior scientist, international counsel, and consultant of the Environmental Defense Fund. □



## Concerns on Melting of Polar Ice Are Eased

by Walter Sullivan

NEW YORK, SEPTEMBER 22, 1992, *THE NEW YORK TIMES*—A study of the flow of the ice off Antarctica's western region supports the theory that at certain times there has been sporadic, perhaps chaotic, discharge of that great ice sheet, but suggests that this is unlikely to occur as a quick response to global warming.

A number of analyses have indicated that in the warm period between the last two ice ages, 120,000 years ago, the oceans were 200 feet higher than they are today, and many scientists believe this was chiefly caused by the discharge of ice from west Antarctica. The new study seems to show that the ice sheet has collapsed, then reformed, several times in the past million years.

### Ice 1,000 Feet Thick

The implication is that at times during that period the seas reached at least that far inland, as would occur if the ice sheet went to sea. Today the ice flows primarily into the Ross Sea, south of the Pacific Ocean, first forming a giant shelf of floating ice about 1,000 feet thick.

The analysis by Dr. MacAyeal was published in the Sept. 3 issue of the British journal *Nature*. Much of his attention has been focused on the ice streams, or rivers of fast-flowing ice, that drain west Antarctic and feed the Ross Ice Shelf.

The most important factor affecting that flow, he believes, is the nature of the glacial rubble, or till, beneath the ice. The base of the ice does not slide across the till, he says. Instead the till deforms in response to the flowing ice. He assumes that the till, filled with water and 15 to 30 feet thick, responds like a fluid to drag by the ice above it.

Swift discharge of ice occurs when the till becomes easily deformable over a large area. This is not related to current climate, he said. Because the till is isolated from the atmosphere, conditions there are affected by long-term climate trends as well as the vagaries of ice-sheet history. □

## Scientists Call Off Robot's Mission Into Volcano

GREENBELT, MD., JANUARY 2, 1993, *THE NEW YORK TIMES*—Scientists called off the robot Danté's mission of climbing down into an Antarctic volcano today after a crucial communications cable between the machine and its control station broke.

The robot, which on Friday started its trek down the volcano, Mount Erebus, had inched about 24 inches into the crater when it ran into problems.

Scientists initially thought the problems they experienced were with a computer at the expedition base station 1.4 miles down the mountain. But today they discovered that the fiber optics communications cable to the robot had had kinks in it as it unreeled and that one of them had resulted in a break.

The National Aeronautics and Space Administration scrubbed the mission after deciding that it would be impossible to repair the cable in time to complete the mission before severe weather set in, scientists said.

The communications cable, through which the robot received its commands and sent back television images and data, was a crucial component in the mission for which there was no backup, they said.

The ambitious mission had been set up to prove the concept of robotic exploration of the Moon and Mars, and to test a new tool for studying the previously unreachable insides of active volcanoes.

When not receiving instructions from the dozen scientists, engineers, and technicians at the base camp, the eight-legged robot was to be operated via satellite from NASA's Goddard Space Flight Center here. On Thursday, scientists at Goddard for the first time took control of the robot's cameras as it sat on the crater rim.

When the robot was under Goddard's control, there was a lag time of 2.5 seconds each way in the communications, similar to the delay in operating a robot on the Moon from the Earth. NASA had hoped that the Danté expedition would give it experience in operating more advanced robots on the Moon and other planets.

David Lavery, manager of NASA's Telerobotics Research Program, said that even though the Danté mission was cut short, he considered the demonstration of the telerobotics portion of the project a success. The project demonstrated that it was feasible to send a robot into a harsh environment and that similar efforts should be considered in the future, he said.

"We are willing to accept a similar challenge and begin again tomorrow," Mr. Lavery said in a communication from Antarctica.

Engineers at Carnegie Mellon University's Robotics Institute, who designed and built the robot, called the attempt a "bold leap" that helped push robot technology out of the laboratory into practical uses in the real world.

Although there was no commitment from NASA to try another Antarctic mission next year, James Osborn, the project manager at Carnegie Mellon, said Danté would be used again once it is retrieved from Antarctica.

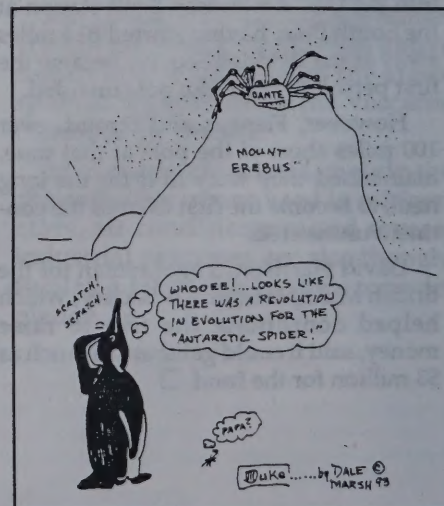
### Thinking Ahead

"We don't know exactly when, but we are thinking of trying it on another volcano," Mr. Osborn said in an interview. "The robot did walk, albeit not far, but all the major components worked, and we learned an awful lot about what to do to deploy it in the field."

Mr. Osborn said the attempt to send the 1,000-pound robot into Mount Erebus was canceled when engineers realized the glass-fiber communications cable could not be repaired at the site or at the nearby American Antarctic base at McMurdo. Any repair or replacement was at least seven days away, he said, and that was too long because the project had to be off the mountain by mid-January.

As the walking robot rappelled down the inner slopes of the volcano with the aid of a tether cable, the fiber-optic communications line, rolled like a ball of twine, was supposed to pull out of a bag, he said. But the line unreeling with kinks in it, he said, and the sub-zero temperatures at the mountain could have been a factor.

It should take a day or two to retrieve the robot and put it back on its carrier for the return trip down the mountain, Mr. Osborn said. □



REPRINTED FROM *FORBES MAGAZINE*—Last Christmas, a friend gave me a beautiful black glass paperweight shaped like the globe. "I thought it fit you, a black-hearted world traveler," he said, referring to my upcoming cruise to Antarctica and my cynical take on just about everything.

Antarctica was nowhere to be found. Where the fifth-largest continent should have been there was instead a "Made in Taiwan" sticker. The globe maker probably never noticed it was missing.

That's typical acknowledgement, I suppose, for what the Romans dismissed as *terra incognita australis* ("unknown southern land"), and the World Book Encyclopedia pegs as "the coldest and most desolate region on earth." Sure, it's cold and desolate; you could even throw in barren, forbidding, and pretty damn unforgiving. But I'm happy to report that in its own way Antarctica is a paradise, well worth the consideration of any traveler who wants something interesting to talk about the next time friends start babbling about Paris.

There's more than one way to tour The Big Ice Cube, which some 5,000 semi-rugged souls do each year. A few countries regularly fly in skiers and curiosity-seekers, and the Chileans even have a barracks-like hotel on one of the islands. But you wouldn't believe how hard it is to get a rent-a-car down there, so for the traveler who wants comfort and class, cruising is the way to go.

Tooling the icy byways of Antarctica is not your typical cruise; indeed, our operators called the whole deal an "expedition. And why not? You don't sail to Antarctica to get a tan by the deck pool. You go to discover, explore, and commune; to slog through penguin guano and get splashed by icy waters; to face frigid blasts head-on, hair matted under a heavy woolen cap, eyes on the lookout for wandering fur seals in your path.

We sailed in February (late summer way down under) aboard SeaQuest's *M.S. Frontier Spirit* (formerly represented by Salén Lindblad), a \$50 million "super ice class" cruiser. The cabins aboard the 361-foot, 164-passenger vessel were roomy and quite nice. Each was a double with a private bathroom, and 18 cabins had verandahs—well worth the extra cost. Dress on board was strictly casual, and they supplied the parkas.

The food was excellent and abundant (alcoholic beverages were extra), and unassigned seating in the dining room fostered plenty of mixing. So too did the *Frontier Spirit's* anyplace-goes policy: even the bridge was open to passengers, and it soon became the hangout for whale-watching in the evening and iceberg-dodging at mid-day.

Surveying the route map prior to departure, the tourist is apt to feel disappointment: *is that all we're gonna*

*see?* But unless you're a scientist there isn't much to *see* on Antarctica proper. It's a big iceball: 98% is under the frozen stuff. More interesting are the surrounding wildlife-studded islands, easily accessible by the Zodiac landing craft stacked on the *Frontier Spirit's* stern.

It had taken us two days, by plane and bus, to get from the States to Ushuaia, Argentina. That was the jumping off point for the Antarctic Peninsula, a 1,400-mile-long jut of rock and ice just 600 miles from South America. The real fun began just hours out of port as the relentless blue of the Drake Passage gave us a gastrointestinal shakedown not to be forgotten. We never hit any 30-foot waves, but we took plenty of furniture-shifting 25-footers. Like most, I awoke after a restless night feeling plum and ten minutes later went prune. It was a good day-and-a-half before we saw the first icebergs of Antarctica—brilliant monsters of

## The Big Ice Cube

by Neal Santelmann



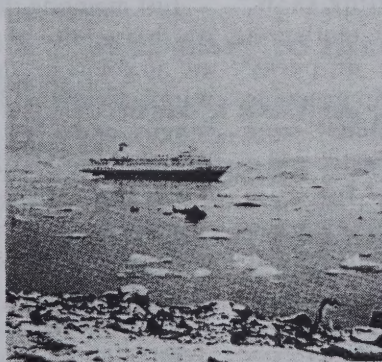
*Souls on blue ice: an Antarctic phenomenon.*

white against blue water and grey sky—and the first penguins swimming shoreward during breakfast.

Our first footsteps on King George Island couldn't help but be a thrill—*WE DID IT, BABY, THE BOTTOM OF THE WORLD!* The weather was mild, and the view of the *Frontier Spirit* resting on crystal blue waters against a towering backdrop of snow and charcoal-grey cliffs was just plain breathtaking.

After the goose bumps faded, though, our first landing site was a tough sell: rock, snow and not much else. The Brazilian scientists stationed nearby snubbed us. The rare and delicate moss we'd been warned to avoid proved unavoidable. And the few skuas in the area were justifiably furious at those who bumbled onto their ground-level nests. Seeing them swoop at the crouching offenders, screeching in terror and rage, gave one a sinking feeling: *just what the hell are we stupid tourists doing here, anyway?*

But we got better (credit the watchful eyes of our expedition leaders), and so did Antarctica. The next morning we made another landing on King George, at Poland's Arc-



rowski Station, and were face-to-beak and -snout with Antarctica's animal kingdom. As the bright sun lit up another magnificent backdrop, molting elephant seals lounged on the shore, a pair of skuas tore into a dead baby penguin, and a gaggle of photo-friendly gentoo penguins did what penguins do best: eat, crap and run around.

Part of the joy of Antarctica's animals is that they have yet to figure out what thoroughgoing bastards we humans are. They're wary, but more because they're unfamiliar with our vertical shape than because they think we're going to kill them. Opportunities for "up close" happen all the time. Those rocks near the water turn out to be a herd of fur seals as you approach. Those blobs on that ice floe are a mama Weddell

seal and her ivory-toned baby. Watch your back step!—you may crush a curious sheathbill, the pigeon of The Deep Freeze.

With Antarctica's environment so delicate, and the resident scientific community so tourist-unfriendly, tour operators are restricted as to where they can drop passengers. But don't worry: you'll see plenty of rough-and-tumble wilderness during the landings, and opportunities for quiet reflection abound. In ten days we saw only one other boat, and no other tourists.

canic land mass with a temper, we crept around the rusted oil tanks and crumbling barracks of an abandoned British outpost that, it happens, neighbored the ruins of an even

older Norwegian whaling station. There was even an airplane in the hangar. But the real treats lay at the end of the strikingly beautiful black beach. After a steep climb, we oohed and ahhed at Neptune's Win-

dow, a natural rock formation with a sheer drop to the sea a few hundred feet below. Then we clung our way across a slope and found a nesting of baby cape petrels, still a few weeks from flight.

Not all landings were exactly empyreal. One afternoon at Port Lockroy, we spent two hours plodding over pungent guano-covered granite mounds as a mass of gentoos—the babies covered with poop—slipped and slid around us. A light snow fell but didn't so much stick as absorb. As one passenger put it: "I can't believe it. Here I am a grown man spending Wednesday afternoon in snow, mud and penguin crap..."

Just motoring through the place is worth the price of admission. There are no colors in Antarctica, save the water, occasional bursts of summer fungus, and a few ancient icebergs gone bubble-less blue. Everything else is grey or black or white.

Still, cruising along in a light snow or heavy fog, with only the hum of the engines as accompaniment, it is easy to lose one's self in Antarctica's cold and quiet beauty: granite cliffs that seem to hang right over the boat, icy mountains that touch the sky, a crunch of ice, a gust of wind, a leopard seal on an iceberg, a watery blow from a whale...

There were none of the usual cruise ship diversions during downtime between landings: no mambo

## **Antarctica's animals have yet to figure out what bastards we humans are.**

Each of our ten landings lasted a few hours, and no two were alike.

While we buzzed icebergs around Half Moon Island, the hum of our Zodiac's engine loosened a hunk of ice that almost took out our little boat. On shore, a lone whaling skiff lay grey and broken in the falling snow, while nearby a colony of perky chinstrap penguins scabbled over rocky peaks, and a herd of fur seals tried to maintain composure amidst our influx. The snowy shore stretched on forever, and a giant iceberg in the harbor made a perfect photo-op for cuddling couples.

On our first landing at Deception Island, a vol-



*More evidence of Madonna's popularity.*



*The dip at Deception Island.*

lessons, no shuffleboard, and (thank God) no Vegas-style "entertainment." This was an expedition, after all, a learning experience. Antarctica was what people came for; Antarctica was what they got.

There were all-day Antarctica film fests on TV in our rooms, daily recaps and Q&As over cocktails in the "Frontier Club," and people were actually using the little multi-language library. And there were the lectures, served up by the expedition staff, including some real-life naturalists. How does "Adaptive Strategies for Feeding, Diving and Breeding in Cetaceans and Pinnipeds in the Southern Ocean" grab you?

Yes, there is something goofy about 120 adults cramming into the "Dolphin Lounge," swaying to-and-fro to the rhythm of the seas while a young zoologist explores penguin breeding habits. But there was nary an empty seat: a little understanding goes a long way down there, transforming, say, penguins from cute and

smelly little flightless birds into *fascinating* cute and smelly little flightless birds. And don't worry, they don't bash you over the head with enviro-ganda—a conscious decision on their part. Better to let awareness of Antarctica's fragility come from learned observation than preaching. (Hint: it works.)

**Cruising along,  
it is easy to lose  
one's self in  
Antarctica's cold  
and quiet beauty.**

On our second landing at Deception Island, we had our shot at one of the more bizarre tourist rituals on the planet: swimming in Antarctica. Tourists hit the beach, strip to their swimsuits, splash into a mingling of the frigid Deception Bay and some underground volcano-heated streams, and then quickly re-dress in the chill as those too wimpy to join in cheer them on.


Sounds easy enough. But when we hit Deception the Bay was raging, so the warm water reached barely 15 feet from the shore. Swimmers who opted for a dramatic running plunge (like me) got the frozen shock of their lives.

Struggling to get dressed, I was bare (save the parka my shivering wife threw around me) and dripping against the elements for a good five minutes before I squirmed into my clothes. *How exciting*, I thought, *to actually worry about the future of one's toes.*

Things really got interesting when our expedition leader calmly announced, "Now *that* looks like trouble." Shivering swimmers turned to see our ship disappear behind a sheet of sleet. The winds roared. The seas churned. The ice slivers pelted. And the Zodiacs were delayed a good ten minutes. Happily, only one swimmer collapsed with the shakes (she was quickly revived), and, after a hellacious ride back (one passenger half-jokingly started reciting the Lord's Prayer), we had the



best hot shower of our lives.

Snug in the coziness of the *Frontier Spirit*, it was easy to forget why Antarctica is the only continent without indigenous human inhabitants. But reminders like the dip at Deception bring you smack back to reality. Antarctica is about as wild, in its elements and its beauty, as you can get these days—which makes it a frontier worth seeing. 

*This winter the Frontier Spirit will make three cruises to Antarctica's Ross Sea below New Zealand, each lasting 22 days. Cost: \$12,000 to \$23,100 per person, including air fare from the West Coast. Departure dates from Tasmania and New Zealand are December 27, January 17 and February 7. Contact SeaQuest at 800-223-5688.*

## Adrift at the Bottom of the World

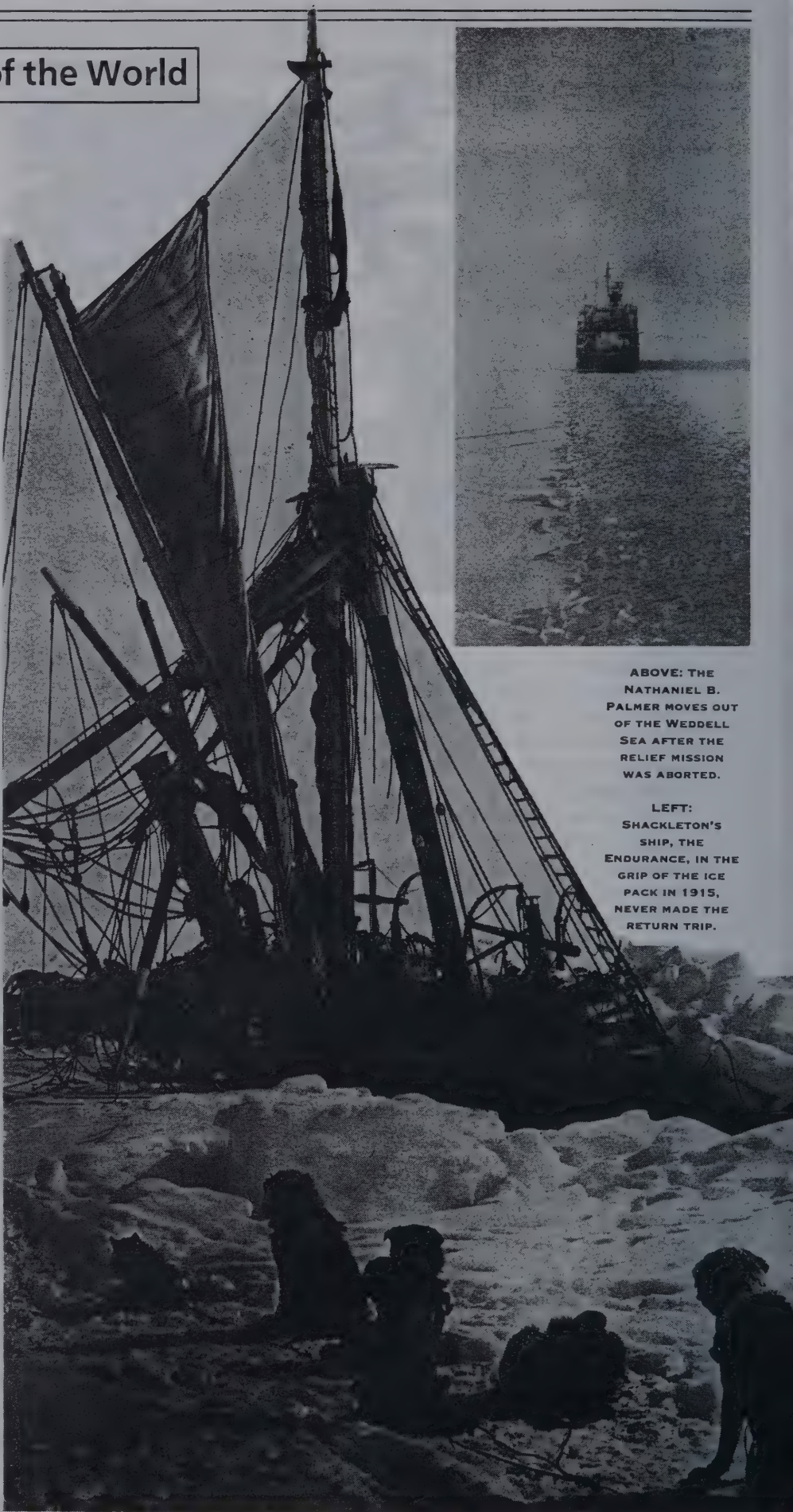
by Walter Sullivan

NEW YORK, NOVEMBER 12, 1992, *THE NEW YORK TIMES*—For four months this year, 16 Russians and 16 Americans lived in a "town" of 30 huts on an ice floe adrift in the least-explored body of water on earth. The crushing ice of the western Weddell Sea had long been the nemesis of any ship that ventured into it, including, in 1915, that of Sir Ernest Shackleton. Until May, when the new American icebreaker *Nathaniel B. Palmer* came within 45 miles of Ice Station Weddell, as the floating town was named, no ship had reached this area and survived.

Although the Weddell Sea is comparable in size to the gulf of Mexico, it is so far south that it does not show up on many maps of the world. Yet it plays an important role in circulation of the world's oceans and atmosphere. Frigid water flows from its depths into the deep waters of the southern oceans, eventually creeping north past the equator and forming a frigid layer that underlies all the oceans except the Arctic. It is thought to play a role in circulation of the planet's entire watery envelope, which keeps Europe warm, the Pacific Northwest damp, and the west coast of South America dry. Recent evidence from southern-ocean sediments, from the Greenland icecap, and from a deep oceanic trench off Norway shows that, particularly near the end of the last ice age, climate and ocean circulation underwent several sudden, drastic changes. Each took place over only a few decades. The scientists at Ice Station Weddell hoped to learn what caused them, and whether they might recur.

In May, I made a midseason visit to the camp, traveling on the *Nathaniel B. Palmer* on her maiden voyage. The fight through the pack was grueling, and 45 miles from the camp the captain gave up the battle and we made the rest of the trip by helicopter. With eight laboratories, four aquariums, staterooms for 377 scientists, state-of-the-art electronics and computers, and a helicopter deck, the *Palmer* is primarily a research station. Named for the 20-year-old Connecticut seal hunter who first caught sight of the Antarctic mainland in 1820, it has a horsepower of 12,700 and the ability to cut through three feet of ice at three knots. It might well have been able to rescue Shackleton's trapped ship, the *Endurance*. It is not the most powerful of the icebreakers. Russia's nuclear-powered ships have 75,000 horsepower engines. The non-nuclear *Polar Star* and *Polar Sea*, both of the United States, are almost as strong, but their full-power fuel consumption is very high.

This was the fifth icebreaker I had ridden into the pack. Each time I have been



ABOVE: THE *NATHANIEL B. PALMER* MOVES OUT OF THE WEDDELL SEA AFTER THE RELIEF MISSION WAS ABORTED.

LEFT: SHACKLETON'S SHIP, THE *ENDURANCE*, IN THE GRIP OF THE ICE PACK IN 1915, NEVER MADE THE RETURN TRIP.

struck by the beauty of the ice. Its gleaming whiteness extends in all directions, broken only by heaps of fractured ice, volcano-shaped hummocks, drifts of snow, and occasional icebergs. Here, as in the open sea, you recognize the horizon-to-horizon seascape as the surface of a great globe, this being a particularly unsullied part of it.

There are many sights peculiar to this region. The crenelated patterns where two sheets of new ice, pushed together, have broken into patterns like interfingering hands which resemble a striking abstract art. Ahead of the advancing ship, fractures in very thin ice propagate almost instantaneously, like jagged bolts of lightning.

New ice assumes many shapes: "grease" ice so flexible that small waves bend, rather than break, it; "pancake" ice, looking more like lily pads whose edges have been crumpled by collisions with other pancakes; "frazil" ice, whose loose crystals act as filters, trapping drifting algae for later incorporation into floes.

Wherever there are openings in the ice there is wildlife. We passed one floe with seven massive crabeater seals, which, with Herculean effort, wiggled into the water as we advanced. Flocks of Adélie penguins, after watching our unfamiliar intrusion, started waddling out of the way, then, in panic, fell on their bellies to propel themselves with feet and vestigial wings. The emperor penguins, as befits their more portly figures, shuffled sedately until the ship became too threatening, then fell to their bellies and fled. We were hundreds of miles from land, where the following winter these penguins would go to lay their eggs among rocks or on coastal ice.

Groups of snowy petrels circled the ship and, after dark, flashed white in the ship's headlights, drawn by good fishing prospects in the newly opened water astern. We saw breathing holes kept open by crabeater seals in the frozen-over channels, and sometimes larger pools created by whales. Small mink shales sometimes poked their heads out to see the advancing monster.

Almost constantly on the bridge was our "ice pilot," Ewald Brune, a German, who periodically climbed a succession of three ladders from the bridge to an enclosed, heated perch in the "ice tower." There he could scan the horizon for "water sky"—low clouds darkened by reflection from open water beneath. In heavy pack, the ship, with its twin screws pounding the ice, vibrated wildly. In the mess hall, which is at water level, the sound of crashing ice floes was like a lion house in which the animals, roaring, screaming, and growling, had gone berserk. Conversation was hopeless.

Our running time was limited, for the sun set in midafternoon, and it was too dark to pick a route until 6:30 the following morning. Some days we received satellite



SIR ERNEST SHACKLETON AND COMPANIONS, AFTER THEIR SHIP WAS CRUSHED IN THE WEDDELL SEA IN 1915.

images of the region, giving us hints of possible leads through the ice. But often the view from space was obstructed by clouds, and sometimes we were brought to a halt when ice fog brought visibility to zero.

During the last week of the ship's attempt to reach the camp there were no ice-free leads in any direction. The floes, many square miles in area and covered with pressure ridges and hummocks, extended unbroken to all horizons. Pressing the ship from both sides, they blocked its efforts to advance. Over and over the ship backed and charged, only to advance no more than a few feet. New snow made the going more difficult, for it cushioned the blow each time. It seemed as though we were doing battle with ice that had taken on a character of its own, and we were losing.

Finally the ship seemed permanently stuck. I could not but recall the ships that had already come to grief in this sea. The master ordered that a crane lift a heavy load over the side, then hoist it up and down, hoping that, with the engines backing at full power, this would roll the ship free. It did not. Like many icebreakers, the ship has heeling tanks on each side that can be flooded alternately to make it roll, but this being a maiden voyage, the system had never been used. When finally operated, the ship slipped free, but it was destined to get stuck several more times.

When we finally came within flying range of the camp, all plans to reach it by ship in our allotted time and deliver provisions were abandoned. Helicopters form the camp, landing on a floe next to the ship, ferried people and priority items in and out. At the camp, we were greeted by Valery V. Lukin of the Arctic and Antarctic Research Institute in St. Petersburg. He wore a classic Russian beard and was leader of the Russian contingent and the camp chief.

The camp had been set up by a Russian icebreaker, Akademik Fedorov, in February, far to the south and in a more accessible area than its current location. The team used helicopters and bulldozers to spread the huts and supplies over the floe, lest

uneven weight crack it. The American contingent, most of whom came in with the Russians, included, in addition to biologists and ice specialists, experts in top-to-bottom measurements of water beneath the floe.

Life on the floe was comfortable but far from luxurious. Most of the inhabitants lived two to a shelter, including one for the expedition's two women, Suzanne O'Hara, and Amy Field, both with the Lamont-Doherty Geological Observatory. Arnold L. Gordon, a Lamont scientist who arrived in June, had helped set up the scientific aspects of the project. Many huts were Russian 7-by-9-foot prefabs formed by panels clipped together. They were snug, but temperature on the floor was sometimes 10 to 15 degrees colder than at shoulder height.

Each hut was heated by a Diesel stove, on which there was usually a pot of melting snow. The resulting water was poured into a vessel suspended over a basin. A spigot under the vessel provided water for personal use. Sometimes heat from a hut melted the ice beneath it, causing the hut to tilt, and it had to be moved.

Some of the Americans lived in semi-cylindrical heavy canvas shelters, where each morning beds were made carefully, not from a passion for neatness, but to ensure that the bedding did not freeze to the walls.

Small gestures helped make life seem normal. When someone had a birthday, token gifts materialized, the Russians providing not only vodka but also medals, commemorative pins, envelopes with exotic postage stamps. On Easter morning, Easter candy was found on each bunk, lying on imitation grass. Chris Fritsen, an American biologist, had been seen loitering near the huts, provoking suspicion about his role. The Russian Orthodox Easter came a week later, and the Russians greeted each other with "Christ is risen," followed by the traditional response: "Indeed, he is risen."

Dave Cotter, one of the expedition's cooks, from Park City, Utah, prepared most of the meals, but his Russian counterpart, Yevgeny Novokhatsky, produced breakfast and special meals.

The camp was divided into "North Town" and "South Town," with huts at either end and, in between, the mess hall, the one-person latrine hut, and food storage depot. The Russian flag flew side by side with the Stars and Stripes. For recreation, there was a sauna, where the Russians liked to retire to smoke and talk politics, and videotaped movies in the mess hall. James Bond and the "Godfather" movies were popular with the Russians.

In February, after the camp was built, the ice opened into a "lead," splitting the camp in two and destroying an airstrip that had been smoothed so ski-equipped planes could land. After that, supplies were brought in by air drop and boats were kept

on the snow in both "towns," lest the floe split some more. If necessary, the camp's two helicopters (assuming they were functional) could lift everyone to a nearby iceberg, where the ice is more durable. Icebergs are sections of continental ice hundreds of feet thick, whereas the floe was a slab of frozen ocean 6 feet to 10 feet thick.

When the Fedorov set up the camp, it pumped Diesel oil for operating and heating the camp into huge bladders on the ice. From these a mobile "gas station" on a sled was filled and towed by snowmobiles to whichever hut needed fuel. In the deep cold, however, wax began forming in the oil. Heaters clogged and occupants woke each morning in frigid shelters. Waxing was finally prevented by an additive that was flown in before the airstrip split.

After the split, supplies were delivered by air drop. The Air Force C-141 cargo plane originated in South Carolina and refueled in Chile and again by aerial tanker. When it sighted the drop zone, marked at each end by a pot belching orange smoke, it made a practice run and then dropped a string of parachutes, each attached to four specially-cushioned drums full of fuel, forming a 1,600-pound cluster. Hitting the snow at 40 miles per hour, the clusters bounced wildly. One seemed headed straight for the onlookers, who fled in all directions. All 115 drums landed intact and most were lifted by helicopter to a central depot.

Through four large holes, each under a heated hut, divers and scientists had access from the camp to the underlying ocean they were there to study. Additional holes were cut in new ice that formed in the new channel. The behavior of the ice covering the Weddell Sea is perplexing. For two years in the mid-70s, satellite images showed that a region of the eastern Weddell Sea that is as large as the Black Sea was completely free of ice—in winter as well as summer. If in the future the ice on the entire Weddell Sea—one-third of all ice on Antarctic waters—were to melt, this would greatly reduce the amount of sunlight reflected into space and surely alter world climate.

Scientists at the ice station measured growth of the ice floe by boring into it and, as the season progressed, measuring changing conditions in the thousands of feet of water underneath. Igor Melnikov, a Russian ice diver, made video pictures of the bottom side of the floe, revealing a world of upside-down valleys, mountains, and caverns rounded by erosion, with up-ended slabs left from ice that had been over-run. Long, salt-dripping pinnacles, or stalactites, had formed as the sea water



BELOW: IN JUNE, THE ICE STATION FLOATED FAR ENOUGH NORTH TO BE RECOVERED BY THE NATHANIEL B. PALMER AND THE AKADEMIK FEDOROV, THE RUSSIAN ICEBREAKER THAT SET UP THE STATION.



froze, shedding salt through tiny channels in the ice.

Swarms of krill—the tiny shrimp-like *Euphausia superba*, which are eaten by the largest animals that have ever lived, the great whales—penetrated the channels, trying to reach algae within the ice. Below the ice, feeding on the krill, were small icefish with outsize fins and heads so transparent that one could see a newly ingested krill inside the fish's mouth. Ctenophores—jellyfish 4 inches to 6 inches long—used their even longer antennae to sting and capture their prey. The ice was so thick in algae that when the Palmer had upended huge blocks as it fought south toward the camp, they looked like frozen caramel custard with a thin frosting of snow.

Although Melnikov is one of Russia's most experienced ice divers, on one of his first dives he had the panicky feeling that something was inexorably dragging him into the depths. It proved not to be some undersea monster but the sinking of a long electric cable that was feeding his floodlight and camera. For each dive, as a safety precaution, the Russian doctor, Dmitri Kirjunichev, was on hand.

Every 10 or 15 miles, as the floe drifted northward, observations were made by dropping a cable with a measuring device through one of the sheltered holes. In places the water was as much as two miles deep. Attached to the cable were water sampling bottles, which were open when lowered, and then closed by a weight sliding down the cable when they reached the depth the scientists wanted to sample. On days of good flying weather, the scientists made measurements at sites up to 50 miles away. They hope eventually to produce a cross-section of water movements into and out of the Weddell Sea, by making observations across its entire width. Earlier attempts to do so by the German research ship *Polarstern* were blocked by the heavy ice.

The water samples were analyzed for dissolved oxygen, as well as tritium derived from nuclear-weapons tests (indicating the amount of time since that water was near the surface). Also measured were three nutrients (nitrates, phosphates, and silicates) to indicate consumption by organisms in each collection area. The abundance of various radioactive isotopes provided further clues to the water's history, such as whether it previously circulated through the Pacific, Indian, or Atlantic oceans. Other techniques were used to measure turbulence and the effect of salt, heat, and ice

drift on the water.

That the floe itself is alternately squeezed and stretched was evident in the water channel that opened through the former airstrip. Overnight it sometimes widened 10 to 20 yards, then closed, creating a ridge of ice 10 feet high. When the lead opened up again, a skim of new ice developed, often covered with "frost flowers," each composed of tiny clustered ice crystals. A flower field may cover many acres and is extraordinarily beautiful. The floe, a mile long and a half mile wide, had probably formed in the ice pack about two years before, and was similar in age to most of the floes in the western Weddell Sea.

As it drifts, the floe becomes thicker, a process that, as the scientists discovered, occurs not at the bottom of the floe, but under the snow layer. As snow accumulates during the long circuitous drift, and as other floes are piled on it by compression, it begins to sink and water penetrates between the ice and snow, producing a slush layer that attracts algae. That layer eventually freezes and, as the process repeats, a succession of algae-rich layers are formed. This floe had grown to more than 6 feet in depth, with parts squeezed into pressure ridges 15 to 20 feet high, some of

whose "keels" extended more than 100 feet under water. Eventually it would drift north, melt and become part of the South Atlantic.

Much of the research was aimed at determining the Weddell Sea's role in global circulation. As the pack ice sheds its salt, the water beneath it becomes more salty and heavy, and eventually sinks thousands of feet to the bottom and begins flowing north. It is this frigid Antarctic bottom water, which to a lesser extent also originates around the rest of Antarctica, that eventually reaches the deepest parts of all oceans except that at the North Pole. As the water sinks, it is replaced by warmer water from more northerly oceans, which rises to the surface in the Antarctic, where it cools and interacts with both the ice and atmosphere. The world's climate is thought to be partly subject to subtle changes in this circulation and its modification by the extent of sea ice.

Gordon's team wanted to determine what factors were responsible for the clearing of the ice in the eastern Weddell Sea from 1974 to 1976. Gordon, an authority on circulation of the oceans, has proposed that this may have been caused by "chimneys" of rising warm water. Trying to understand the probable response of the pack to global warming is a major goal of the project, and at the Goddard Institute for Space Studies in New York, part of NASA, Douglas Martinson of Lamont-Doherty, who for a time led the Americans on the floe, is participating in an effort to "model" the factors that control world climate. The biggest uncertainties, he says, are the roles of pack ice and clouds in altering climate by reflecting solar energy back into space.

Another factor in climate control is the extent to which the ocean in this region absorbs (or releases) carbon dioxide, the "greenhouse gas." As Martinson points out, the atmosphere contains 700 billion tons of that gas and the oceans hold more than 50 times that much. "If the oceans so much as hiccuped," he says, they could absorb or discharge enough of the gas to have a major effect.

"We don't know," he adds, "whether the Weddell Sea is a net contributor or absorber."

According to Peter E. Wilkniss of the National Science Foundation, which financed the American part of the project, such processes are too important a part of the world's climate system to ignore. To predict change, he said, "We at least have to know how it's working now," and this was essentially the goal in the Weddell Sea.

Battling with the Antarctic pack has a venerable history. Ice Station Weddell had been established close to where the *Endur-*

*ance* became trapped before Shackleton could land his expedition on the continent. His ship was then carried helplessly in the same drift that governed the camp and was finally crushed as the pressure became intolerable.

Thirteen years before Shackleton's trip, on the other side of the Antarctic peninsula, the *Belgica* had been trapped; both Frederick A. Cook and Ronald Amundsen were aboard—the former later claimed to have been first at the North Pole, the latter would be first to reach the South Pole. Between 1901 and 1904 two more expeditions became trapped: The first was a German ship, which, like the *Belgica*, was beset on the far side of the continent. During the long winter that followed, their steam-powered ves-



Access to the ice station varied according to its position. It was in an area of very heavy ice in May.

sel exhausted its coal and they escaped only by burning the fatty bodies of penguins.

The story of the second expedition is one of the less well known Antarctic adventures. In 1903, the Swedish ship *Antarctic* had landed its leader, Otto Nordenskjöld and five companions on Snow Hill Island, near the tip of the Antarctic peninsula. The ship was to pick them up the next summer, but it never came. After the Swedes endured a second winter, Nordenskjöld and a companion, sledging across ice between the island and the mainland, experienced a remarkable encounter.

Coming toward them were two men who, Nordenskjöld wrote in his account, were "black as soot, with black clothes from head to foot, black faces and tall black caps." Their eyes were covered with strange boxes which, according to Nordenskjöld, "blended so closely with the

black facial color that the whole seemed like some kind of silken mask with wooden openings for eyes.... Never before had I been confronted with such a mixture of civilization and the most utterly conceivable degree of savageness. My capacity for speculation was transfixed as I endeavored to discern what sort of men these might be." Antarctica was then almost totally unexplored, much less inhabited. Nordenskjöld's companion suggested that they might be confronted with "unknown Antarctic aborigines."

The "natives" proved to be three colleagues who, when ice conditions blocked efforts by the *Antarctic* to reach Nordenskjöld, had been landed on the tip of the Antarctic peninsula to cross the intervening pack and tell him the situation. Open water had made this impossible and the hardy Swedes, equipped only for a trail journey, built a stone hut and endured the next winter, living on seals and blackened by smoke from burning blubber.

Meanwhile the *Antarctic* itself became beset and eventually sank. The crew camped on the ice until drift carried them within reach of Paulet Island, east of the peninsula, where they built a hut whose walls are still standing.

They needed 3,000 to 4,000 penguins and as many seals to survive the next winter, using seal skins to roof the hut. The surviving members of the expedition were eventually rescued by an Argentine ship, outfitted in part by a young Ernest Shackleton who, more than a decade later, led what is by now the most famous escape of all from the Weddell Sea, after the *Endurance* was beset.

By the time Ice Station Weddell was closed down in June, the floe and surrounding pack had drifted almost due north along 53 degrees east longitude at an average of four miles a day. Before it turned north, however, the clockwise flow, or gyre, that governs ice in the Weddell Sea carried it westward. Wind and current drove the pack westward against the Antarctic peninsula, which is the longest peninsula on earth.

Because of international provisions against degradation of Antarctic's pristine beauty, all elements of the camp had to be removed in June when the *Akademik Fedorov* and *Nathaniel B. Palmer* reached the floe as it drifted toward the South Atlantic. Tin cans were stamped flat and bottles saved. So were garbage and non-burnable waste.

After the Weddell camp had been evacuated, Lukin and Gordon summarized some of their findings: The special environmental setting of the Weddell Sea, they concluded, "makes it a key constituent of the

global climate system." They noted that their studies had revealed vigorous vertical movements of heat, salt, dissolved gases, and nutrients in the water beneath the ice. These, they believed, could influence the atmosphere, the ice cover, and the region's biology, and inject cold, oxygen-rich water into the depths.

They had found that the western Weddell Sea basin, from which the bottom water originates, is far larger than had been supposed, extending 60 miles farther west. The continental shelf nearer the coast, how-

ever, is 300 feet below sea level, rather than the 500 feet shown on maps. Current estimates are that 20 to 30 million cubic meters of bottom water flow out of the Weddell Sea basin every second.

The Weddell studies are not over. The readings obtained so far cover only part of that sea. More such floating bases are anticipated, as indicated by the official name of this one: Ice Station Weddell 1. Numerical designations of Russian stations now adrift near the North Pole run into the 30s.

Understanding the many-layered ocean currents and countercurrents that determine the world's climate depends on top-to-bottom measurements in all the oceans. Those recently conducted in the Weddell Sea fill a major gap, but are far from complete. Knowledge of what controls water movements throughout the world is still fragmentary and stands as a challenge to those who sail the seas and, in particular, venture to the southern extremities of the world ocean. □

## Team Reports: Finding Continent's Deepest Gorge

by John Nobel Wilford

NEW YORK, THE NEW YORK TIMES, AUGUST 2, 1992—Sounding the bottom of a thick Alaskan glacier, scientists have made measurements showing what they feel sure is the deepest gorge in North America, perhaps in the world. It is the Great Gorge, on a flank of Mount McKin-

ley. The readings, made with seismic instruments used in subsurface mapping and oil exploration, show the gorge to extend almost 9,000 feet, as measured from the peak of Mount Dickey, straight down the granite walls to where the surface of Ruth Glacier runs through the chasm, and then further down through the glacial ice to the bottom. The depth of the glacier, which had been the big unknown, was found to be 3,770 feet.

"This glacier, if devoid of ice, would be almost exactly 9,000 feet deep, one of the greatest defiles in the world," said Bradford A. Washburn, a mountaineer, cartographer, and retired director of the Museum of Science in Boston.

### Comparing to Depth Records

By comparison, the Grand Canyon is 5,300 feet deep from the rim to the bottom. The deepest canyon in the world, according to the Guinness Book of World Records, is El Cañon de Colca in Peru, at 10,574 feet. King's Canyon in California, between the Sierra and Sequoia national forests, is 8,200 feet deep.

Recognizing depth records becomes a problem of semantics. Geologists make a distinction between canyons and gorges. A canyon is wider than it is deep; the Grand Canyon's width at the rim ranges from 4 to 13 miles. A gorge is deeper than it is wide; the Great Gorge is almost twice as deep as it is wide. It has two sides; the other side is a mountain called Moose's Tooth, almost as high as Mount Dickey.

Dr. Keith Echelmeyer, an associate professor at the Geophysical Institute of the



University of Alaska at Fairbanks, said in a telephone interview that some gorges in the Himalayas could turn out to be deeper, depending on future depth probes of some remote glaciers.

The probe of the glacial ice in Great Gorge was undertaken at the instigation of Mr. Washburn, who arranged for financial support, and was directed by Dr. Echelmeyer, a glaciologist. Mr. Washburn, who has mapped Mount McKinley as well as Mount Everest and the Grand Canyon, said that after his first trip to the area in 1937 he had suspected Great Gorge would be among the deepest in the world.

### "Very, Very, Very Deep"

"Every flake of snow that falls on the southeastern flanks of Mount McKinley pours downward and is squeezed through that mile-wide gorge," Mr. Washburn said. "I knew the gorge had to be very, very, very deep."

Dr. Echelmeyer's first attempt to probe the bottom of the glacier last year was a failure. He tried to determine the depth with conventional ice radar systems like those used in Antarctica. By sending radio signals into the ice and receiving their echoes off the bottom, these instruments had little trouble measuring ice depths of more than 2,000 feet.

At the Great Gorge, though, Dr. Echelmeyer ran into a couple of frustrating problems. The gorge is so deep and narrow that the radio signals were bouncing off the side walls and returning a confusing jum-

ble of noise. Also, the scientist learned, the Alaska ice pack is warmer than Antarctic ice, which means it includes much more liquid water, which tends to weaken radio signals passing through the ice pack. The signals were not reaching the bottom.

So, in June, Dr. Echelmeyer's party returned to the gorge and brought with them sticks of dynamite and 12 receiving units called geophones, basic tools of seismic exploration. He and his assistants dug holes in the ice, planted the geophones in a wide-spread array, and set off dynamite explosions, repeated several times. These dull thuds sent sound waves moving through the ice to the bottom, then bouncing back to be picked up and timed by the geophones. Analyzing the return signals led the scientists to calculate the ice depth. Dr. Echelmeyer's team included Ted Clark, a graduate student, Kent Swanson of the Polar Ice Coring Office at the University of Alaska, and Christopher Larsen, a research technician at the Geophysical Institute.

In another measurement, using navigation satellites, the scientists determined that the Ruth Glacier is moving at an average speed of 3.3 feet a day, which is relatively fast for a glacier. One of the fastest glaciers, in Greenland, gallops along at 75 feet a day.

Glacier ice covers as much as 10 percent of the world's land surface. In the most recent Ice Age, which ended 10,000 years ago, the ice cover was up to 30 percent, reaching areas as far south as Chicago and New York City. □

## For Arctic Data, Ask a Polar Bear

by Clyde H. Farnsworth

CHURCHILL, MANITOBA, NOVEMBER 29, 1992—The helicopter bucks and sways. Dr. Malcolm A. Ramsay is riding behind the pilot over the wind-whipped taiga of northern Manitoba. He anchors his left arm in the open window and aims a rifle at the lumbering yellowish-white shape below.

The rifle gives a faint pop and a four-inch-long Telazol tranquilizer dart jabs the shoulder of the big, hungry polar bear. Within four minutes it is temporarily immobilized.

The pilot, Steve Miller, drops Dr. Ramsay off in a clearing near the fallen animal, and returns to the Churchill Northern Studies Center, about 75 miles to the north.

He will return in a few hours to pick up Dr. Ramsay and whatever he has learned about the ecology of the taiga, a coniferous forest in northern climes, from a brief visit with one of its most prominent citizens.

Because of its peculiar biology, the polar bear acts as a blotter for the stresses on the Arctic environment, and scientists are studying it to learn about chemical pollution, global warming, and other potential threats to the survival of this species as well as humans.

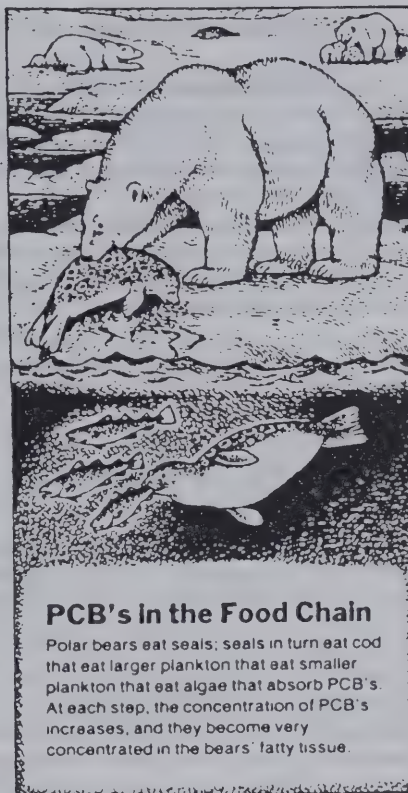
Wrapped in layers of liners, a cavernous parka, thermal boots, thermal socks, and thermal gloves, Dr. Ramsay, an associate professor of vertebrate ecology at the University of Saskatchewan and one of Canada's leading experts on polar bears, gives the sedated beast sprawled on the snow a physical as thorough as any company doctor gives a corporate executive. With a winch, tripod, net, and electronic scale, he weighs the bear. Other instruments measure its electrical resistance to determine its lean body mass, as opposed to adipose tissue, or fat.

With pliers he extracts a vestigial premolar tooth that the bear does not use to determine the animal's age. The tooth builds up rings like the trunk of a tree.

From the femoral vein, he draws blood samples for biochemical tests. He takes a sample of fat tissue for later analysis of polychlorinated biphenyls (PCBs), industrial pollutants that make their way into the polar bear's niche and become concentrated in its fatty tissue. Researchers already know that the levels of PCBs in the bears are dangerous and could start having effects on reproduction.

### Search for Danger Levels

Biologists are now trying to ascertain the danger level for PCB concentration in polar



bears. For seals, Dr. Ramsay says, deleterious reproductive effects are evident in the PCB levels of 70 parts per million that have been recorded in the blubber of Baltic Sea seals. These animals have been practically wiped out over the last two decades.

The Baltic is a known dumping ground for materials containing PCBs. Probably reflecting this, adipose tissue of polar bears in the Svalbard Islands north of Norway has recently been found to have a concentration of 32 parts per million. Hudson Bay is not yet such a dumping ground, and the mean level of PCB concentration in the Churchill area bears was most recently recorded at eight parts per million.

Every year between August and the end of November, Dr. Ramsay comes to Churchill to study the species, *Ursus maritimus*. Over the last dozen years he has similarly examined more than 1,000 of the species.

Churchill is a popular place for the study because it is easily accessible, by rail or plane, and because the bears congregate in the area just before Hudson Bay freezes. Then they move out on the ice for the ringed seals that are their basic diet. Until the ice forms, they do not eat or drink for periods often exceeding four months.

"Why do I like to work with polar bears?" the professor asked. "I guess it's because they live in a very simple ecosystem. They feed on a single species, live in a simple environment. It's easier to understand the ecological principles at work in a simple ecosystem than it is in the tropics, or the timber region, where interactions are more complex."

The knowledge he is accumulating about this "simple" system could prove important not only for an aloof and remote species roaming the roof of the world, but for humans.

### Ability to Retain Mass

During their long fast, even longer than that of other bears, polar bears meet their energy requirements from fat reserves. These are extensively depleted. Every day of fast they burn up one to one and one-half kilograms of fat.

But while the fat is burned off, the protein mass of the bear remains constant, or declines only gradually, because polar bears are able to recycle proteins internally. Humans and most other mammals show a continuous loss of these compounds while fasting.

But Dr. Ramsay's examinations have shown that polar bears are blessed with some kind of biochemical pathways that avoid use of kidneys. Instead, the urea of the bears is converted back into amino acids, the building blocks of proteins.

Just how they do this is a mystery that Dr. Ramsay thinks may be solved in the near future. He is working on finding the answer in a joint project with Dr. Ramsay and Dr. Ralph A. Nelson, chairman of the medical school of the University of Illinois.

If they find a special enzyme in the bear that facilitates the conversion of urea wastes back into amino acids, bypassing the kidneys, and if it can be reproduced pharmacologically, it might help humans with kidney failure to avoid dialysis.

### Signals to Track Bears

Some of Dr. Ramsay's bears get collars emitting radio signals that bounce off satellites and can be picked up by telemetry receivers in the helicopter. This permits him to follow reactions in the same animal over a span of weeks or months. In selected bears next season, he will inject urea molecules labeled with a special nitrogen isotope. He will then try to find the same bears again to track those molecules through the biochemical pathways.

But ecology looms large in his research. He is studying the buildup of contaminants like PCBs, which are now found in the Arctic food chain. PCBs, banned in North America and most of Western Europe, but still produced in Eastern Europe, Asia, and other less developed areas, are apparently borne by winds to the northern seas and absorbed by marine life.

Polar bears at the top of the food chain eat the seals that eat the cod that eat the larger plankton that eat the smaller plankton that eat the algae that absorb the PCBs. At each rung of the food chain, the concentration of PCBs increases.

Once ingested, the PCBs become concentrated in the fatty tissue of the bears.

"We don't yet know what happens to the PCBs when the bears fast and burn up their fat reserves," Dr. Ramsay said. "Are they broken down by the liver and excreted from the body? Are they broken down somewhere else? Are they concentrated in the remaining fat? Are they transferred to the cubs through the mother's milk?"

He and graduate students who join him on some of his northern expeditions, like Susan Polischuk, a 25-year-old masters candidate, and Stephen Atkinson, 24, a Ph.D. candidate, are trying to find answers, joined by Dr. Ross J. Norstrom of Environment Canada, a leading expert on PCBs in

food chains, who works closely with Dr. Ramsay.

Polar bears are not technically an endangered species. They are protected by law in all Arctic countries. In Canada, Indians and Eskimos are permitted to kill a certain number of the bears each year.

Still, Dr. Ramsay worries about their susceptibility to "catastrophic events" in the future. The PCBs are only one danger. Global warming is another.

Any rise in the mean annual temperature changing the dynamics of sea ice could

further shorten the time of their feed with disastrous consequences.

Another possible source of trouble is that their food supply might die off, as occurred recently in the North Sea, when masses of gray and harbor seals perished from an epidemic.

Still another threat is polar bears' limited genetic variability. This has been determined in studies of their genetic blueprint, DNA. Thus, with any sudden change in their environment, they might not have the flexibility to cope. □

## At 87, Norman Vaughan Ready to Scale Another Peak

Scan a list of Norman D. Vaughan's achievements and it looks seamless—the perfect record of a long, fortunate life.

The bearded, 87-year-old adventurer was a Congressional medal of Honor winner, Antarctic explorer, and confidant of Adm. Richard Byrd; he's been an Olympic competitor, officer in two wars, medical missionary in Labrador and Newfoundland, archeologist, successful author, and finally, in old age, 13-time competitor in Alaska's Iditarod sled dog race, a 1,100-mile slog through some of the earth's toughest, coldest terrain.

Vaughan, who bills himself as the "oldest and slowest," has completed six grueling Iditarods, most recently in 1990—at age 85.

So broad are his exploits, his friends have made up a baseball-style card of his achievements, with his photo on the front. But the list only skims his rich life, and more's to come.

In December, he hopes to scale 10,300-foot Mount Vaughan in the Queen Maud Range in the Antarctic interior, a yet-unclimbed, rocky peak named for him 60 years ago by Byrd, and to stand atop it on his 88th birthday. As astounding as that sounds, those who know him don't doubt he'll pull it off.

Vaughan lives in a log cabin 120 miles north of Anchorage with his wife, Carolyn, and their 30 dogs. The only way home in winter is by dogsled or snowmobile, which suits them fine. With a plastic knee and a fused ankle, Vaughan gets around without complaint, as vigorous as men half his age.

All of which may leave the impression of a fellow who's slid down the greased skids of life, who went from a home with a butler on Boston's North Shore to Milton Academy to Harvard University to a plum job at an ad agency.

All those breaks indeed were Vaughan's. But hard times tell more about a man than easy ones, and, somehow, for all his advantages, Vaughan wound up picking up more splinters on his pants than grease.

In 1974, after his snowmobile business and third marriage went up in smoke, he moved to Alaska with \$100 in his boot, no job, and nowhere but the back of his pickup to sleep. He was 66.

"Norman heard about a janitor's job at the University of Alaska at Anchorage," said Jennifer Johnston, a friend, "so he went over and applied. They looked at his age and said, 'What makes you think you can do it?'"

"Norm said, 'Do you have a mop?' They said, 'Yes.' He said, 'Do you have two?' So they gave him two. He took one in each hand and marched down the hall swishing them around like he was stirring two big pots of soup. Then he turned around and marched back the same way. They said, 'Okay, you've got the job.'"

So began the Alaska phase for Vaughan, who resigned from the Air Force as lieutenant colonel after 14 years and wound up happy to swing mops. He stayed at the university 6½ contented years, working nights and running his sled dogs during the day, and left only when mandatory retirement age forced it. Then he settled down to write his book, *With Byrd at the Bottom of the World*, with coauthor Cecil Murphy.

Byrd had asked all who assisted him on his historic first flight over the South Pole in 1929 not to write about it for a year so he could get his account out first. Vaughan honored the promise by waiting 60 years; the book reads as if he hasn't forgotten a thing.

So who is this amazing character and what makes him tick?

Vaughan is in New York this week promoting his Antarctic venture, which will cost \$1.5 million to mount. Sponsors are needed, so he bounces from interview to interview in a joyful spring, braving icy winds in a sport coat while the natives turn up their overcoat collars. His grace startles new Yorkers. No woman ever walks through a door behind him.

He told a radio man at WNYC that the three veteran Alaska mountaineers who will accompany him and Carolyn up

Mount Vaughan are so strong and fit, "They could carry me up to the top in a litter if they had to." The radio man paused, then asked what sort of litter they'd be bringing.

"Oh no, no," laughed Vaughan with gusto. "That's a joke!"

Vaughan plans to start the November voyage as close to Little America on the Ross Ice Shelf as he can get. That's where Byrd's base camp was 64 years ago. From there, the five explorers will head 500 miles inland by dogsled, just as Vaughan did on a three-month geological exploration while Byrd was flying over the pole.

They'll take it easy, shooting for an 18-mile-a-day average and leaving plenty of leeway in case storms and 40-degrees-below-zero temperatures slow their progress. The aid is to be at the base of Mount Vaughan by mid-December and make the relatively easy final ascent on December 19, the day Vaughan turns 88.

Vaughan, the first American to drive a dog team in Antarctica when he piloted Byrd inland in 1929, hopes to be the last human to drive a team there. An international treaty calls for all non-indigenous animal species to be removed from Antarctica by next year.

Once dogs are off the continent, Vaughan will have little reason to go back. He's kept sled dogs all his life, from age 12, when he and his childhood pal Eddie Goodale hooked up the family pooches in Massachusetts to his middle years when he worked at the Pentagon and ran a team from behind a truck chassis in the woods of Vienna, Va., to old age, when he ran the Iditarod.

Sled dogs played the key role in all his best exploits, said Vaughan, who added modestly, "I haven't done anything anyone couldn't do."

Which is true enough, sad to say. From sleeping in tents in 40-below cold to mopping floors at age 66, he's not spent a lifetime doing what others couldn't do. Just what they wouldn't. □

# 1992 midwinter airdrop: A view from Amundsen-Scott South Pole Station

*Editor's note: Since 1981, U.S. Air Force C-141 transport airplanes, in support of the U.S. Antarctic Program, have air dropped fresh food, supplies, equipment, and mail to the wintering populations at Amundsen-Scott South Pole Station, as well as personnel on Ross Island at McMurdo Station and New Zealand's Scott Base. Each year in June, usually near Midwinter's Day (21 June), two airdrops are scheduled for McMurdo Station and one for the South Pole. The airdrop over the South Pole is the most difficult—extremely low temperatures and the dark polar night prohibit landing, so the C-141s must refuel in flight in order to make the nearly 10,500-kilometer round trip from Christchurch, New Zealand.*

*This year's airdrops, which occurred on 13 June (Ross Island and the South Pole) and 15 June (Ross Island only), brought 64 bundles containing supplies, equipment, and mail to McMurdo Station and Scott Base and 18 bundles of materials to the South Pole. At the South Pole on the day of the airdrop, the surface temperature was  $-40^{\circ}\text{C}$ , but when the windchill factor was taken into account, temperatures dropped to between  $-72^{\circ}$  and  $-79^{\circ}\text{C}$ . Blowing snow reduced visibility to about 0.5 kilometers. Despite these harsh conditions, all of the bundles landed undamaged and were recovered by the station crew.*

*Articles in previous issues of the Antarctic Journal have documented these midwinter deliveries and described how the airdrop is accomplished. In this issue, however, this event is recounted from a different perspective—that of a South Pole winterer. Hopefully, this description will give readers a better understanding of life at this isolated site.*

*This account was written by Stephen Warren (Department of Atmospheric Sciences, University of Washington). Dr. Warren spent the 1992 austral winter at Amundsen-Scott South Pole Station to continue his study of the optical and physical properties of the antarctic snow surface. During this period, his investigation was focused on measuring the spectral distribution of thermal infrared radiation from the atmosphere.*

## Midwinter visitor

Amundsen-Scott South Pole Station  
Tuesday, 16 June 1992

The winter airdrop was scheduled for Saturday, 13 June—the only delivery of mail and freshies between February and October. Gary, our station manager, called a planning meeting for Wednesday evening, at which I parceled out my remaining supply of chemical hand-warmers and toe-heaters to everybody for use during the airdrop recovery—I was expecting a big shipment to replace them. After the meeting, we brought in and decorated the Christmas tree.

A blizzard began on Thursday, continued throughout the airdrop, and continues today. On Saturday at 1:45 p.m., the airplane, an Air Force C-141, came. It had flown all the way from New Zealand (5,311 kilometers) and would return to New Zealand without landing, so it had to be refueled in the air by a tanker-plane over the southern oceans.

In order to see our smudge-pots marking the drop-zone on the runway, the plane had to descend below the clouds; yet it had to remain above 458 meters to allow the parachutes sufficient time to open. Kitt and Bob were reporting clouds at 305 meters all morning, so we doubted that the airdrop would occur. It's a one-shot event—if it fails, we don't get our mail until October.

The plane was able to see the drop-zone. Eighteen parachute bundles drifted down from the dark sky, and three teams, each carrying a radio and followed by a tractor with a forklift, were sent out to find them.

After watching the drop, Bob and I were on our way inside to help with unpacking, but we decided briefly to be tourists and walked out with Team 3 toward the smudge pots. We wanted to see how the parachutes were attached and how deeply the bundles had dented the snow. It turned out that Team 3 consisted of just Dave and Joe. They asked for our help, so we ended up working with them for 3 hours.

We trudged out into the blizzard. For a short while we could still see Team 2 in the distance to our left (Bill, Mike, and John), silhouetted by Darrell's blinding headlights as he lumbered along behind them, bouncing over the sastrugi.

Away from the headlights it was pretty dark; the moon was obscured by blowing snow and thin clouds. In 3 hours, our team located seven of the bundles. Each bundle (a big cardboard container) weighed about 500 pounds. (And by the time we reached the last one, its parachute also weighed about 500 pounds, because of the snow that had drifted onto it!)

We walked far out onto the runway, beyond the new telescope building, to find the most remote bundle. It had split open on impact, but nothing had fallen out. We righted the bundle so the forklift could get under it; then Bob walked out north into the darkness to search for more distant bundles.

Dave and Joe were sheltering behind the box out of the wind, waiting for Martha to return with her forklift after delivering our first three bundles to the dome. I peaked through an opening in the broken cardboard. By the moonlight I could see that it was full of small parcels. Curious as to whether the mail for McMurdo Station had

been dropped here by mistake, as had happened last year, I pulled out one package, borrowed Dave's flashlight to illuminate it, then asked Joe to look at the address. Through his ice-encrusted eyelashes, his frosted glasses, and a swirl of blowing snow, he was still able to make out his own name on the package: Joseph P. Migliore!

By 4:30 p.m. all 18 bundles were inside the dome. Drew had discovered how to use a butter-knife to remove the cargo-straps. Dan and Jim helped Paul hang the parachutes to dry over the volleybag court. They shook the loose snow off them; then Roger swept it out the door.

By 6:00 p.m., Betty and Jarvis had sorted all the mail in the galley. Peter turned on the Christmas-carol music, and the package-opening began. I opened only what was unexpected; the eleven boxes of cargo I had requested from Von and Susan at the University (four of them full of hand-warmers and toe-heaters) could wait. The very first package I saw was from a long-lost friend: what a surprise; how did she even get my address?

Saturday evening I briefly left the cheerful chaos of the mail-opening party to check on Susan's experiments out at the Clean Air Facility. Before returning, I stood on the balcony and leaned against the railing for a while in the brisk warm wind (25 knots and  $-40^{\circ}\text{C}$ ). Besides the nearly full moon, the bright stars Alpha and Beta Centauri also shone dimly through the blowing snow. Two days later the full moon, as far above the horizon now as the Sun is below it, would be eclipsed for 3 hours by the Earth's shadow.

Kitchen cleanup duty comes every 22 days; Sunday was my day. It involved more work than usual because of all the packaging trash, and because Jerilyn prepared a special Christmas dinner with turkeys, wine, candles, and tablecloths, so I got a lot of help from volunteers. Jeff and Dale were also there all afternoon unpacking fresh pineapples, watermelons, onions, and eggs.

I'm reluctant to admit this to my friends and relatives who took the trouble to send me those (now much-appreciated) letters and packages, but I guess it has to be part of the complete story: I was not eager for the airdrop. I still hadn't yet read all my "February" mail, and I still had enough work and reading material to keep me busy for another year at least. I had settled contentedly into the pleasant life of a remote station, able to restrict news from the outside world. The airdrop threatened to disrupt my routine, bringing in tempting distractions before I'd completed my work on what's already here. (Even after the airdrop, I thought I might hold off for a few weeks before opening my 11 boxes from Seattle, but Martha the cargo-chief is after me to inventory them by tomorrow.) The airdrop cracked open the South Pole cocoon and forced the world upon us at least briefly, which I'm sure was a good thing for everyone.

## Icy Base to Receive a Face-Lift

by Dana Tims

EUGENE, OREGON, *THE OREGONIAN*—When the National Science Foundation decided that the nation's aging research facility at the south Pole needed an architectural face-lift, the logistical problems were immediately apparent.

Expecting architects to make a house call to Antarctica, after all, was only a little less likely than a snowball's chance of surviving summer at the equator.

But when NSF officials decided to tap a different vein by holding a nationwide competition, University of Oregon architecture Professor Guntis Plesums jumped at the chance to throw his students into the icy fray.

The move turned out to be a good one. UO students submitted six winning entries, including the first-place finisher, in a competition only a little less fierce than the race staged by explorers Roald Amundsen and Robert F. Scott to reach the South Pole.

The icing on the students' cake was a free trip to Antarctica's McMurdo Station to inspect first-hand the one-square-mile facility that they already had completely revamped on paper.

"As a learning experience, the trip was invaluable," said Plesums, who returned to Eugene this week after accompanying the group and their architectural jurists. "From a practical standpoint, no one expects them to put into practice the ideas we came up with."

That's because the competition, sponsored by the American Institute of Architecture Students, asked students to start from scratch. Only the 38-year-old facility's new science lab was to be left standing.

In reality, however, political and financial considerations guarantee that any renovations at the site will be gradually instituted.

"At this point, we really don't know what will happen next," said Guy Guthridge, manager of the NSF's Polar Information Program and a frequent McMurdo visitor. "But we do know we now have a compelling reason to make McMurdo a better town."

McMurdo Station is the nation's largest Antarctic science facility. Research there proved instrumental to scientists' discovery in 1985 of a gaping hole in the atmospheric ozone layer over the South Pole.

During long, cold Antarctic winters, only about 250 scientists remain at the base. During summer, however, the number swells to nearly 1,250.

The students' goal was to give the sprawling, labyrinth-like base a true sense of community, Plesums said. Such cohesiveness never has been part of the station, largely due to the piece-meal fashion in which it grew.

The winning team included UO architecture students Diane Oliver and Robert Heaney, and John Carper, a student at California State University, San Francisco.

The group's design was selected over the other 31 entries largely because it focused on renewing substandard buildings, reducing maintenance, energy conservation and compatibility with the surrounding environment, Plesums said.

During the group's on-site visit, daytime temperatures averaged a balmy 27 degrees, Plesums said. That was up a bit from the minus 30 degree readings commonly seen during winter in the Antarctic.

Even if the students' design suggestions are never incorporated, Plesums said he and the other transcontinental travelers will never forget the stark beauty of an afternoon at the South Pole.

"It was a moving, almost spiritual, experience that I doubt any of us will ever forget," said Plesums, who, during a day off from educational tasks, got the chance to ski across the frozen snowfields.

"Everything hampers getting things done in Antarctica," Guthridge said. "The only thing we don't bring in is water."

Once a year, a cargo ship brings in the bulk of the town's supplies, including non-perishable food and the eight million gallons of Diesel fuel needed to operate the station's heat and electricity.

As a result of the limited access and lack of planning, the station has grown in a hodgepodge fashion as weather conditions allowed.

Dormitories are scattered across the complex. Each has separate heaters, though

## Students' Design Gives New Order to Antarctic City

by Joni James

Eugene, OR, Feb 1993

*THE REGISTER GUARD*—Until Guntis Plesums felt his heel fall through the snow, the day had been one of only pleasant sensations.

Cross-country skiing on the world's coldest, highest, and driest continent had its rewards. Antarctica's summer sky was clear, the sun shining, the temperature mild, the workout enough to cause Plesums, 59, to break a sweat.

But the fear immediately sheared those pleasurable thoughts. As his heel sank momentarily, Plesums'

mind recalled stories of others who had fallen into ice crevasses and perished there—unable to be rescued by their fellow skiers.

"Antarctica is that danger, vulnerability," the University of Oregon architecture professor said Thursday, a week after he returned from the home of the South Pole. "It is the only experience I had of that (danger), and I wished I'd experienced more."

Until the skiing expedition, Plesums had spent most of his 10-day visit to Antarctica insulated in McMurdo Station, the hub town of the National Science Foundation's polar program that offers a tight-knit

community of 1,200, warm buildings, three meals a day, and video cassette players.

The foundation flew Plesums, two of his students, and a California student to the continent Jan. 3 after they submitted the winning entry in a national contest for how to redesign McMurdo, one of the world's most remote research sites.

The science foundation wants to reduce the 85-building station's impact on the environment as well as make the entire operation more streamlined, efficient, and less vulnerable for the next century. □

one boiler could easily heat more than one building, Plesums said.

The cafeteria is located in the same building as the barracks for Naval personnel. Administrative services are stashed in several different buildings. Warehouses are far from where their contents are needed.

The poor planning is more than just inconvenient, Plesums said. McMurdo can be downright impossible when the weather hits Condition 1—total whiteout from a snowstorm—or condition 2—freezing fog that prevents vision past four feet.

"It seems they got people to (build) who wanted to do it rather than those who are most qualified," Plesums said. According to Guthridge, the architect team Plesums was part of is the first to visit the station.

Last spring, Plesums took on the contest of designing a new McMurdo as a class assignment for his fifth-year students.

The contest had few rules: The overall size of the town—one square mile—couldn't grow; the newest building, a state-of-the-art science laboratory, couldn't be changed; and the helicopter pad and the dock made of ice that receives the cargo and tanker ships once a year couldn't be moved.

"Here was architecture reduced to the basics," Plesums said. "I told my students to raise their sights very high. This was their chance."

But Plesums' instructions weren't without constraints. Though students could search the clouds for ideas, the ideas had to be firmly rooted in an understanding of the continent and its harsh conditions.

Buildings must be built on steel stilts as much as 10 feet tall—or else, ice will pack around the building and the warmth emit-

ted from a building will cause the building to sink into the ice.

Wood—though ideal for the conditions—is a fire hazard. And since the station relies solely on Diesel fuel for heat and electricity, it's not an option. So buildings, from floor to ceiling, must be constructed of steel.

All structures must be able to withstand the wind, which hovers around 40 ph, but has reached 200 mph on other parts of the continent.

In the end, six of the nine designs Plesums' student submitted to the foundation's contest were recognized for outstanding work.

But the grand prize winner—which led to the free trip to Antarctica and \$1,000—was a plan submitted by UO students Robert Heaney and Diane Oliver, and a University of California at Sacramento student, John Carper.

Heaney graduated from the UO in the summer. Oliver, who is still in the architecture graduate school, had not returned to Eugene Thursday.

The Heaney-Oliver-Carper plan called for leveling the station, except for the science laboratory, and replacing it with a single building that mimicked an enclosed "Main Street." Along a single concourse, different departments would sprout off on both sides, creating a social center along the "street."

"The judges found it was more imaginative and grounded in reality," than some of the other entries, Guthridge said. "It was something you could actually do," he said.

But when Plesums, the students, and the judges who selected the entry arrived at the complex Jan. 3, they changed their mind about what McMurdo should be.

"They sensed that because of the history, there was some logic to the place," Guthridge said.

For the next 10 days, the team of architects modified the plan significantly. Instead of leveling the whole complex, they recommend demolishing 30 buildings. They'd relocate or adapt another 20 buildings, and keep another 30 buildings as it.

If the team had its druthers, it would also build a welcome center, complete with an exhibit that showcases U.S. research on the continent.

"You can forget that. . . the beauty of Antarctica is that it is full of imminent, hidden dangers. You can know that intellectually, but there are some things you must learn through your skin. Even sensing the (force of) wind is a bit of a surprise," Plesums said.

Recommendations from the contest will be presented to the foundation's board for possible implementation. However, no timeline or budget has been committed to the project, said Guy Guthridge, spokesman for the foundation's Antarctica programs.

McMurdo, which is accessible only during certain months of the year by plane and boat, is best known for the discovery in 1986 that chlorofluorocarbons, or CFCs, were burning a hole in the Earth's ozone layer.

Established in 1955, the town is at its capacity during the summer months, October to February, when scientists work during 24-hour sunlight, and temperatures climb as high as the mid-40s. During the winter, when temperatures can dip to minus 58 degrees, only a skeleton support crew of 250 lives there. □

## OBITUARIES

### W. J. CAMPBELL, 62, Meteorologist Who Was an Expert on Polar Ice

Dr. William J. Campbell, a ranking meteorologist for the United States Geological Survey and an internationally known expert on polar ice, died last Friday. He was 62 years old and lived in Gig Harbor, Wash.

The agency, which reported the death late Wednesday, said he had suffered a heart attack.

At the time of his death, Dr. Campbell headed the agency's ice and Climate Project, based on the campus of the University of Puget Sound in Tacoma, Wash. He played a leading role in interpreting data

sent by earth-satellite sensors regarding polar sea ice.

### Adrift on Ice Island

He was instrumental in the development of interagency and international remote-sensing experiments of the polar ice regions and was a member and director of several large-scale projects in that field.

He wrote and co-wrote more than 130 papers and received many citations, including the United States Antarctic Medal (1965), the Soviet Union's Arctic Medal (1974), and several team awards from the National Aeronautics and Space Administration.

A native of Brooklyn, he was an alumnus of Brooklyn Technical High School and a physics graduate of the University of Alaska. As a graduate student, he spent 15 months studying ice physics while adrift on an ice island in the Arctic Ocean. He also

survived a plane crash at the South Pole in 1963, the year before he earned his doctorate in atmospheric physics and oceanography at the University of Washington.

A sought-after expert on sea-ice dynamics and remote sensing, he lectured at many universities in this country and abroad. He joined the United States Geological survey, a branch of the Department of the Interior, as a member of a team studying sea-ice and glacier dynamics and was appointed chief of the agency's Ice Dynamics Research Project in 1969.

Dr. Campbell is survived by his wife, Dr. Nelly Mognard Campbell, who is also a physicist; two sons, Christopher and Nicolas; and a brother, Dennis.

(CONTINUED NEXT PAGE)

## OBITUARIES, cont.

### J. ROBIE VESTAL (1942-1992)

In early August 1992 the polar community sadly learned that J. Robie Vestal, former chairman of the division of Polar Program's (DPP) advisory committee, died of complications resulting from a brain tumor.

A microbiologist at the University of Cincinnati since 1983, Dr. Vestal worked in the Arctic and the Antarctic, studying microbial ecology of aquatic, marine, and terrestrial habitats. In Antarctica, his research focused on adaptations of microbial ecosystems to extreme environments.

Dr. Vestal was born in Orlando, Florida. He received his bachelor's degree in biology from Hanover College in 1964, his master's degree in microbiology from Miami University in 1966, and his doctorate in microbiology from North Carolina State University in 1969. Besides serving on DPP's advisory committee, Dr. Vestal was a fellow of the American Academy of Microbiology and a member of the American Society for Microbiology, the Arctic Institute of North America, the American Society for Limnology and Oceanography, Sigma Xi, the Society for Industrial Microbiology, and the Society of Environmental Toxicology and Chemistry.

### RICHARD B. BLACK (1902-1992)

Admiral Richard B. Black, who established the U.S. Antarctic station East Base on Stonington Island, died of cancer on August 11, 1992, at a nursing home in Bethesda, Maryland.

During his career, Admiral Black, a civil engineer with a degree from the University of North Dakota, participated in five expeditions to Antarctica. Two of them were with Richard E. Byrd—the first as a civilian member of Byrd's second expedition (1933-1935) and the second as leader of the Antarctic Service Expedition (1939-1941). In 1954, as an operations analyst in the Office of Naval Research, he returned to Antarctic-related work to assist in the planning of the U.S. expedition to Antarctica during the International Geophysical year (1957-1958).

As a commissioned officer in the Naval Reserve, Admiral Black served in the Pacific theater during World War II. During the Saipan campaign he was awarded the Bronze Star for his direction of troops and supplies through a narrow channel while under attack. He also served in the Korean War. After he retired from the reserves in 1962, he was promoted to rear admiral for

his wartime service. Although no longer on active duty status, Black continued to work on Antarctic programs at the Office of Naval Research until he left the government in 1967.

Black Coast, on the east coast of the Antarctic Peninsula between Cape Boggs and Cape Mackintosh, was named for the admiral in recognition of his contributions to the U.S. Antarctic effort.

### EMANUEL D. RUDOLPH (1927-1992)

Emanuel D. Rudolph, Director of Ohio State University's Institute of Polar Studies (now the Byrd Polar Research Center) from 1969 to 1973, died on June 22, 1992, in Columbus, Ohio, as a result of injuries sustained in a traffic accident.

Dr. Rudolph was born in New York, New York, in 1927. He received his bachelor's degree from New York University in 1950 and his doctorate degree from Washington University in St. Louis in 1955. In 1961 he joined the faculty at Ohio State University where he taught botany until 1989, when he retired as a Professor Emeritus. During his career at Ohio State, he served as chairman of the botany department (1978-1987) and Director of the Environmental biology Graduate Program (1972-1978).

A specialist in lichenology, Dr. Rudolph participated in three research expeditions to Antarctica between 1961 and 1964. He published over 40 scientific papers on lichens and the history of botany. He was a fellow of the American Association for the Advancement of Science, the Ohio Academy of Science, the Arctic Institute of North America, and the Linnean Society of London. In recognition of his Antarctic research, Rudolph Glacier, a tributary glacier in the Victory Mountains of Victoria Land, was named for him.

### SHIRLEY ANDERSON, "Antarctic Mom"

Shirley Anderson, a Pacific Beach woman whose warm heart kept the chill off long months spent in Antarctica through her letters to hundreds of navy personnel stationed there, died last Sunday at San Diego Hospice of congestive heart failure. She was 70.

Mrs. Anderson was known as "Antarctic Mom" over the three decades she corresponded with Navy men and women. The mantle fit in more ways than one. In addition to writing, she often opened her home to "Operation Deep Freeze" military personnel passing through San Diego who needed a hot meal or a place to sleep for the night.

One who came to visit between trips to the ice in 1981, Navy public affairs officer

Lt. James R. Geltz, ended up falling in love with Mrs. Anderson's daughter, Lynnette, and marrying her. It was fitting, for it was Lynnette who, as a teenager more than 20 years earlier, had first suggested to her mother that she write to Navy men stationed in "the coldest place on Earth."

Mrs. Anderson was a native Australian, born in Bunbury on May 17, 1922. She met her future husband, James C. "Andy" Anderson, himself in the Navy, during World War II and immigrated to the United States to marry him after the war ended.

Lynnette was in the Girl Scouts in 1959 when she made the suggestion.

"Mom wanted to do something because we (the family) had been in the military for so long," she recalled. "I found out about Antarctica in school. They said, 'Well, that's the coldest, loneliest place.'"

"I just suggested, 'Why don't you write to the people down at the South Pole?'"

Mrs. Anderson rose before dawn and wrote two or three letters each day, addressing them to everyone, from admiral to seaman. They all received the same treatment, her daughter said.

"She always wrote a personal note," she said. "She did not type up a blanket letter. She always got a list of men and women and wrote whatever she thought would be interesting to them."

Mrs. Anderson gave her letter writing tips to an interviewer in 1969.

"Always look to the brighter side," she said. "Be cheerful. Tell about anything that pleases you and say nothing of the things that displease you. The boys just want to hear a little something about how good it is at home."

For her efforts, she was named an honorary four-star admiral by Adm. Elmo Zumwalt. She received gifts from the ice-bound continent, including the first chalice from the Chapel of the Snows, photographs, plaques, and items like a leather penguin or a towel inscribed, "U.S. Antarctic Research Program."

She was invited to Sea World when the aquatic park on Mission Bay added penguins to its collection.

But although she had a couple of offers to go, she never saw the place she wrote to so many hundreds of times.

"No, I feel that I've been there many times," she told an interviewer in 1974. "I like my thoughts, and I get to wondering if it would spoil it to go."

Mrs. Anderson is survived by her husband; her daughter; a son, Douglas, of Pacific Beach; and two grandchildren.

A communion and last rites were administered at San Diego Hospice; interment was at Fort Rosecrans National Cemetery. Memorial contributions may be sent to the hospice at 4311 Third Ave., San Diego 92103. □

## HERO News

The Richard E. Byrd National Antarctic Center is about to become a reality. A ground-breaking ceremony was held on November 2 in Reedsport, Oregon, for our first display building, the Antarctic Discovery Center. The

center—a joint project by the City of Reedsport and the Hero Foundation—was funded by a combination of State of Oregon, federal, and private grants. Construction has begun and is expected to be complete by spring of 1993.

The Antarctic Research Vessel *Hero* has been dressed up with a new pier

which will accommodate direct access to the vessel. A marina has been constructed aft of the ship for sail-in visitors, and there is a jet boat pier which offers jet boat excursions up the Umpqua River as part of the complex of attractions.

The *Hero*, which served in both the Arctic and Antarctic under the aegis of the National Science Foundation, has been transformed into a magnificent display vessel, thanks to ten men from the Oregon Department of Corrections who spent a year renovating the ship. The *Hero* is open to visitors daily from 10 a.m. to 4 p.m. Old polar explorers are welcome to stay aboard for the evening when they are traversing the Oregon Coast.

We do need your help. We need to raise funds for development of displays both in the Antarctic Discovery Center and aboard the *Hero*. Many of you have fund-raising experience for projects such as this, and we welcome your advice and suggestions.

However, we are proud of the progress we have made and are very thankful for the support of all who have contributed time, artifacts, and money. It is only a beginning, and we encourage your continued support. Please join the Hero Foundation and help to build the National Antarctic Center. □



Antarctic research vessel HERO in front of Discovery Center, which will open its doors in June 1993.

## HERO FOUNDATION

Development of the Richard E. Byrd National Antarctic Center by the Hero Foundation is a project that is national in scope. Although the United States has led the world in Antarctic research and exploration, very few Americans have ever had the experience of visiting Antarctica, and because of the difficulty and expense of traveling, very few ever will. The National Antarctic Center will, accordingly, bring an "Antarctic Experience" to the United States to educate and inspire the American people about Antarctica. We expect to eventually accommodate over a million visitors per year.

We invite all Antarcitians and Antarcitians-in-spirit to join the Hero Foundation and support this project with their contributions and help to realize this vision.

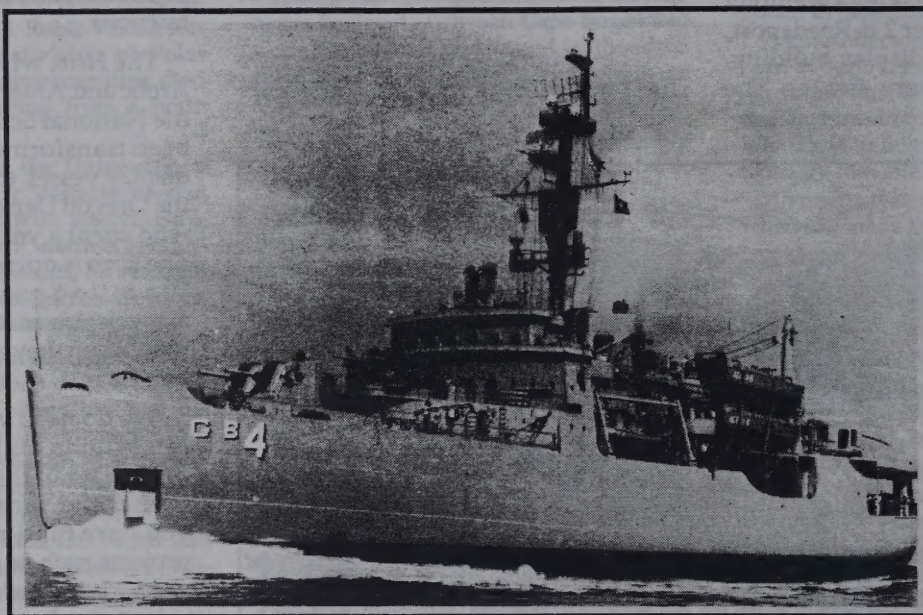
Sincerely,

*Brian Shoemaker*

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## THE DEATH OF THE ICE BREAKER FLEET:



### How You Tried to Save Her and What Is Happening to Her

America's icebreaker fleet, which was used to explore the polar seas for over 60 years, is gone!

A valiant attempt was made by many old Arcticans and Antarcticans to save the last of this proud armada, the *USCGC Glacier*, in a five-year running battle with government bureaucrats who fought tooth and nail to have the ship destroyed. In the fall of 1992, *Glacier* was assigned to the Navy by the Maritime Administration to be used as a missile target—this, despite the pleas by the Hero Foundation and the City of Reedsport that they were willing to take care of her in perpetuity. When "Big Red," as she was nicknamed is finally sunk during some Naval target practice, our nation will have lost an important link with its heritage of polar exploration.

She still floats, but will soon be towed to Port Hueneme, California, where she is to be destroyed. Is there some knight on a white charger out there, willing to rescue this grand old dame in distress? □